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THE REMUNERATION OF ELECTRICAL ENGINEERS.

Anyone who keeps closely in touch with the developments in all branches of the electrical industry cannot fail to be an optimist regarding its future. This is the age of electricity. The demand for men trained to make available its beneficent powers for the service of society is bound to increase. For the best results of all a healthy balance of the demand and supply of men so trained is needed.

An interesting commentary on this subject was recently made by Prof. E. W. Marchant in England; extracts from his address are reproduced in another part of this issue. While some parts of his address apply only to British conditions, many points he makes are of international interest. Thus he finds excellent prospects in all lines of electrical engineering, but a particularly hopeful future in connection with the electrification of railways and in the commercial development of electrochemical processes.

Throughout Professor Marchant's address he refers repeatedly to the poor remuneration of most electrical engineers and the deterrent influence this has on getting the best men to join the profession. This condition is peculiarly true in many European countries, but it also prevails to too great an extent in America. Central stations, manufacturers, telephone and telegraph companies, etc., cannot hope to get the greatest results possible from their engineering departments unless they induce the most capable men to join them by offering greater rewards, nor can they expect to hold even the most conscientious and loyal though less brilliant men unless they make it worth while. Especially in a large organization is it desirable to develop a fine *esprit de corps*, not only in order to make experienced men reluctant to leave their posts, but to encourage all the men to put enthusiasm and energy into their work. An engineer who has given years to his technical training and who is intelligently devoting his knowledge and experience to the interests of his employer, has a right to expect adequate compensation. There is too marked a tendency to pay meager salaries to the engineering staff. This results in failure to attract the best men and in frequent changes in the personnel, all to the detriment of the work turned out.

Of the number of electrical engineering graduates turned out of our technical schools, the percentage that go into consulting work seems to be gradually

decreasing and the percentage that enter the service of the manufacturing and utility interests is increasing. It behooves these interests to realize that, in the words of Professor Marchant, the income now derived by most electrical engineers from their profession is generally not high enough, considering the importance of the work they have to perform. At the same time the supply of engineering graduates can be doubtless better regulated by the technical schools. The deans of such institutions should keep their fingers on the industrial pulse and urge their students to take up such engineering courses as the demands of industry call for most, thus preventing an over supply in any one line.

ELECTRICAL EQUIPMENT OF GASOLINE AUTOMOBILES.

The discussion last week at the meeting of the American Institute of Electrical Engineers on the subject of the electrical equipment of automobiles brought up a subject which had not previously been considered in Institute meetings, but one which deserves thorough discussion at the hands of electrical engineers in order that practice may be reduced to a basis of correct engineering, which means the highest efficiency and economy which can be combined with reliability and satisfactory operation. This application of electric power is comparatively new and it is probably too early to advocate standardization in the sense of limiting the design of control apparatus or the generators and motors themselves. Some standardization would be desirable, however, within the limits of the distinct types now in the field. The wide variation in the outfits now on the market claiming the attention of the automobile manufacturer, with their confusing claims for high efficiency and excellence of service, is more likely to retard general adoption of electric starting and lighting apparatus than to accelerate it. Thorough discussions of the advantages and the defects of the various types by a body of qualified and experienced engineers, along with thorough tests of the various equipments by disinterested parties, would greatly help the development of this application of electric power.

Many questions involved in this subject cannot be definitely settled without years of experience in actual operation, such as the merits of separate units for starting, lighting and ignition, or the combination of two or more of these functions in one apparatus. This is largely a contest between simplicity of the whole and simplicity of the parts. The discussion in New York has served to emphasize some of the requirements for apparatus intended for this purpose and it should stimulate improvements in the design. It is significant that the type of apparatus most severely criticised at this meeting and which must be admitted to have serious imperfections from an engineering standpoint has met with wide commercial adoption presumably because other types which may lack its unique defects have proven no more satisfactory in every-day operation.

THE CONSERVATION CONGRESS.

At the fifth annual International Conservation Congress, which has been held in Washington this week, the subject of water power has occupied a prominent position. This is a subject of intense interest and great importance to the electrical interests of the country, since water-power development today means the generation and transmission of power electrically. While a full report of the Congress cannot be given at the present time, an abstract of one of the papers presented will be found elsewhere in this issue.

It is unfortunate that those interested in the development of water powers have not been able to agree upon the conditions of such development and have thus retarded the utilization of this natural resource. On the one hand we have those interested financially in such developments, and upon the other those interested in the public weal and who are afraid that the control of our white coal will fall into the hands of those who will manage it in a way which will be detrimental to the public good. The conflict between these two elements arises largely through misunderstanding by each of the purpose and attitude of the other, a condition which has only been aggravated by their mutual opposition. Broad-minded financiers and electrical engineers realize that the conditions under which developments of water powers on navigable streams and upon public lands are made must be such as to safeguard the rights and the welfare not only of the present but of future generations; and on the other hand broad-minded statesmen and publicists realize that this development will not take place unless the integrity of the invested capital is properly secured and the conditions made such as to permit an adequate return upon the investment. There should be no difficulty in formulating a policy which will include all of these requirements.

Many delegates from the Western States went to Washington declaring the present water-power policy to be radically wrong and seeking to have the Government change it. They declared to the Congress that the present policy discourages and renders unprofitable the one inexhaustible natural resource of the country, and they demanded that the Government adopt a new policy, which, while offering inducements to private capital, will at the same time thoroughly safeguard the interests of the public and the Government.

What effect the attitude of these delegates on the Senate and House of Representatives will be this coming winter of course remains to be seen. In the past 30 years Congress by special act has authorized the building of 92 power plants on navigable streams in the United States. Of these, 59 acts were passed prior to 1906, when the federal dam act went into effect. Under these 59 acts 24 plants were built, less than 40 per cent. Since 1906 Congress has author-

ized the building of 33 power plants on navigable streams, and but three of them have been built—one in eleven that were able to develop power in accordance with the governmental policy.

On non-navigable streams of the West, where the Government owns power sites, the Forest Service, up to June 30, 1913, has issued 175 permits for power plants designed in the aggregate to develop 783,600 horsepower. To date 111,200 horsepower has been developed under these permits. Construction was started on other projects contemplating the development of 122,500 horsepower, but these projects have never been completed, and the remaining projects, contemplating the development of 549,900 horsepower, have been utterly abandoned, the permittees being unable to borrow money to finance their projects on such uncertain title as the Government offered.

There is undoubtedly a nation-wide demand for cheap power, yet the past Government policy, both with regard to power development on navigable streams and on Government lands is shown by these figures to retard, not to encourage development.

THE IMPROVEMENT OF STREET-CAR-ILLUMINATION.

Riding on our modern street cars is a vastly different thing nowadays from what it was 20 or even 10 years ago. In speed, safety and comfort our present street cars are marvels compared with those of bygone days. Each improvement has brought increased traffic and further improvements will no doubt still more develop the riding habit of the public. Of the many improvements in street-car transportation, however, one feature has not kept pace with the progress achieved in other lines. This is the illumination of the car at night. True, as the size of cars has increased, more lamps have been provided for the interior illumination; the voltage regulation on many lines has also been greatly improved, thus materially reducing the candlepower fluctuation of the lamps. In spite of this, the illumination in too many cases is inadequate and in nearly all cars clear, bare lamps are still used, producing highly objectionable glare at all times when the voltage is at or near normal. In other lighting fields there has been a most healthy movement for betterment which urban transportation companies have scarcely yet taken up seriously.

Fortunately, indications are at hand of an awakening in this respect, which is bound to be productive of much good. In several Massachusetts and Ohio cities experimental studies of the subject have been made. The results of some of this work at Toledo were published in this journal a few weeks ago. In the present issue is given an abstract of a paper by Messrs. Porter and Staley, giving the results of other investigations. The manufacturers of tungsten lamps must be credited with having initiated this actual betterment work. Although their campaign naturally lays most stress on the marked advantages of replacing the old carbon lamps by tungsten units, the desirability of properly screening the more brilliant lamps is also pointed out. In view of the fact that a considerable number of bare tungsten lamps have recently been installed in street cars it was doubtful, however, whether the lamp manufacturers would insist on their equipment with shades or reflectors. Now that the reflector manufacturers have actively taken up the propaganda, the prospects for decided improvement are very good.

In the investigations reported on by Messrs. Porter and Staley, as well as the similar investigation of steam-railway coach lighting conducted last summer under the auspices of the Association of Railway Electrical Engineers and reported in a recent issue, it was found that an illumination of two to three foot-candles was required on a plane 45 degrees to the vertical and three feet above the floor, this corresponding to the position in which the average reading passenger holds a paper or book. While this is an excellent criterion of the intensity of the illumination, it is by no means the only one to be taken into account. Such an illumination could be furnished readily by a sufficient number of bare lamps, but this would be far from an ideal installation. By the replacement of carbon lamps with tungsten lamps an increased illumination can be had at reduced cost; thus one railway company anticipates saving about 1,000,000 kilowatt-hours per year after the lighting of all its cars is remodeled. Such a saving would easily tempt a company to make the change so as to increase the illumination at a minimum cost.

It must be borne in mind that of the number of passengers riding while artificial illumination is needed only a relatively minor part are reading passengers. During the evening rush hours the percentage of passengers reading newspapers eager to learn the day's events is quite high, but at all the remaining evening and night hours the percentage of reading passengers is very small. Now what does a non-reading passenger desire in the way of illumination? He desires sufficient and not excessive illumination. Moreover, he desires a lighting equipment that will not tire nor injure his eyes, in other words, a comfortable and if possible a pleasing illumination entirely free from glare. Since indirect and semi-indirect lighting is practically out of the question in street cars, this means that such shades or reflectors must be used as will not only effectively reduce the intrinsic brilliancy of the lighting units to a minimum but will screen the entire lamp itself to all normal vision and incidentally present a pleasing appearance. Therefore, in selecting a reflector its efficiency, while highly important, is not the only thing to consider. From the company's standpoint it should be both efficient and easy to clean, while from the passenger's point of view it should be substantially glare-free and of pleasing aspect. It is to be hoped that the latter features will be given due weight, especially as they can be secured at a trifling cost.

Meeting of Chicago Credit Association.

The eighteenth annual meeting of the Electrical Credit Association of Chicago was held at the Hotel La Salle on Friday, November 14. A business meeting was held in the afternoon at which the reports of the officers and committees were made, and officers were elected for the ensuing year as follows: President, A. O. Kuehmsted; vice-president, Henry Schwab; secretary-treasurer, Frederic P. Vose; national representative, F. M. Pierce.

Papers dealing with co-operation between sales and credit departments were presented by A. J. Gaehr of the George Worthington Company, Miss Elizabeth N. Smith of the Bryan-Marsh Electric Works, and W. H. Fogarty of H. W. Johns-Manville Company.

W. J. Burton of St. Louis made an address regarding the activities of the Moral Risk Club, and talks upon the subject of discounts were made by C. J. Burton of the Peru Electric Railway Company and by Frank Horton. At 6:30 p. m. the annual banquet was held in the Louis XVI banquet hall of the hotel, Frederic P. Vose acting as toastmaster. An innovation at the dinner this year was the presence of ladies, a toast to whom was responded to by the president-elect, A. O. Kuehmsted. Mr. Kuehmsted was introduced by S. E. Kennedy.

Bishop William F. McDowell made an inspiring address upon the subject, "Other Riches," and Edwin M. Skinner spoke upon the topic "Use and Abuse of Credits." George Bruce Amsbary also responded to a toast. Music was furnished by the Oxford Quartet as well as by an orchestra and Männerchor.

Louisville Jovians Meet.

The initial step in a movement to place Louisville, Ky., on the Jovian map was consumated on November 11 at a luncheon held at the Henry Watterson Hotel. January 15 was selected as the date for a rejuvenation which will be the first held in the Falls City. James Clark, Jr., who has been appointed statesman for Louisville offered a prize for the member securing the largest number of applications. Tentative plans were made for the establishment of a permanent Jovian league.

The luncheon, which was due to the efforts of V. L. Crawford, of St. Louis, statesman-at-large, was attended by James Clark, Jr., Walter Clark, Harry I. Wood, Paul Tafel, Carl A. Klemm, Herbert E. Ottenheimer, W. H. Sparks, W. O. Smith, all of Louisville; E. L. Callahan, H. Ehrlich, Chicago; and V. L. Crawford, of St. Louis.

Annual Meeting of the American Society of Mechanical Engineers.

The annual meeting of the American Society of Mechanical Engineers will be held in the Engineering Societies Building, New York City, on December 2, 3, 4 and 5. The opening session will be on Tuesday evening, December 2, when the presidential address will be delivered, followed by a reception in the Society rooms.

On Wednesday morning there will be a business meeting, followed by a technical session at which the following papers will be presented: "Notes on the Further Operation of Large Boilers of the Detroit Edison Company," by J. W. Parker; "Setting Tasks for Firemen and Maintaining High-Efficiency in Boiler Plants," by Walter N. Polakov; "Properties of Steam," by R. C. H. Heck.

On Wednesday afternoon there will be parallel sessions devoted to the subjects of railroads, cement and textiles.

On Wednesday evening the Grashof medal of the Verein Deutscher Ingenieure will be presented to George Westinghouse. This will be followed by an address by John W. Lieb, Jr., on "Leonardo Da Vinci—Engineer and Artist."

Other technical sessions will be held on Thursday and Friday mornings. Among other topics, machine-shop practice and gas power will be discussed on Thursday, and fire protection on Friday. One of the papers at the latter session will be "The Fire Hazard in Turbogenerators," by G. S. Lawler. Thursday and Friday afternoons will be devoted to excursions which will include the Waterside station of the New York Edison Company, the Interborough Rapid Transit Company, the Port Morris power station, the Brooklyn Rapid Transit power station and the works of Crocker-Wheeler Company, De la Verne Machine Company and the Westinghouse and General Electric lamp works.

On Thursday evening there will be a German dinner, at which an account of the summer trip to Europe, illustrated by lantern slides, will be given by Worcester R. Warner.

Arc Lamps as Substitutes for Safety Gates.

The City Council of Shelbyville, Ky., has decided that arc lamps, properly placed at outlying railway street crossings, are as effective as safety gates, and has therefore, rescinded an ordinance compelling the railroads entering Shelbyville to provide gates at all points where the railroads cross public thoroughfares within the city limits. This action has resulted in the railroads contracting for about 60 additional arc lamps.

Electrical Exports for September.

The following data relating to the electrical exports from the United States for last September are obtained from the monthly summary of imports and exports issued by the Bureau of Foreign and Domestic Commerce, Washington, D. C.

An increase of over $400,000 is shown in the total values of electrical shipments in September over the corresponding month of a year ago; the average of the monthly totals for 1913 is shown being well maintained. The number of articles exported in the four classes for which the numbers are reported were as follows in September: electric fans, 4,877; arc lamps, 237; carbon-filament lamps, 267,807; metal-filament lamps, 85,954.

In the following table are given the classified figures for September and also for September of a year ago, as far as the detailed figures for the latter are available:

Articles.	Sept., 1913	Sept., 1912.
Batteries	$ 65,332	.....
Dynamos and generators.	161,400	$ 339,393
Fans	64,901	28,758
Insulated wire and cables	213,094	.....
Interior wiring supplies, etc. (including fixtures).	70,777	.....
Lamps—		
Arc	3,835	19,880
Carbon-filament	29,944	16,787
Metal-filament	20,235	31,196
Motors	491,473	183,347
Static transformers	129,486	.....
Telegraph instruments (including wireless apparatus)	15,164	24,430
Telephones	196,140	122,916
All other	792,473	1,075,393
Total	$2,254,254	$1,852,400

Safety Exposition and Award of Medals.

The first award of the E. E. Harriman Memorial Medals will be made at the First International Exposition of Safety and Sanitation, to be held in New York City, December 11 to 20, under the auspices of the American Museum of Safety. The Jury of Award includes J. B. McCall, president of the National Electric Light Association.

The Safety Exposition will be the occasion of the annual meeting and dinner of the American Museum of Safety, which will be held at the Waldorf-Astoria on the evening of December 12. All of the awards will be made on this occasion, including the Harriman Memorial Medals, the Safety Exposition Medals, and the annual medals of the American Museum of Safety, consisting of The Scientific American, the Travelers, the Seaman and Rathenau medals.

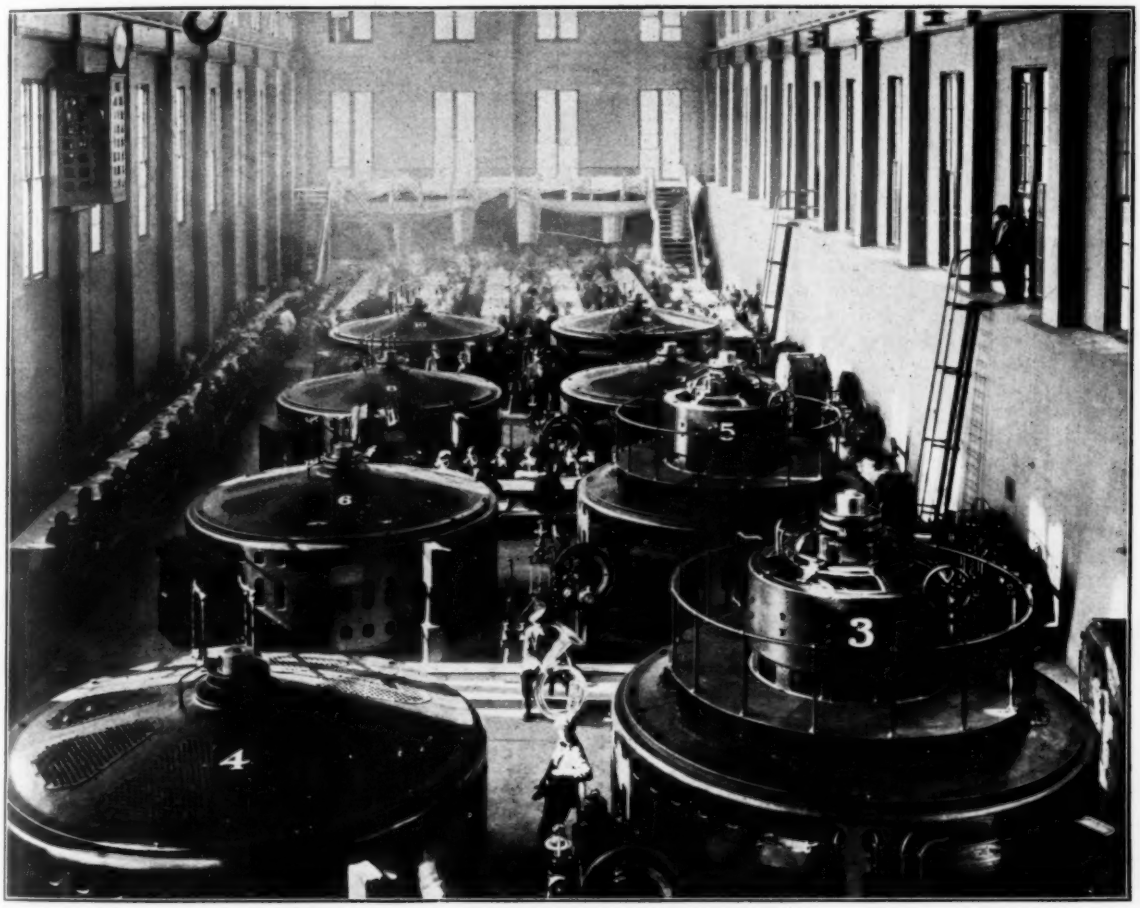
Jovian League of Chicago.

Frank T. Fowler, of the Life Saving Devices Company, Chicago, interestingly described the Lungmotor at a meeting of the Chicago Jovian League on November 17. Homer E. Niesz, statesman, presided at the meeting.

Hydroelectric Development on the Tennessee River.

Chattanooga and Tennessee River Power Company's Station at Hale's Bar Largest Project in the South.

After eight years of constant and almost ceaseless labors, the imposing hydroelectric plant at Hale's Bar, on the Tennessee River, 33 miles below Chattanooga, constructed by the Chattanooga & Tennessee River Power Company, stands forth complete. Damming, as it does, one of the largest navigable streams of the South, representing many years of work, costing nearly $10,000,000, generating ultimately 65,000 horsepower of electric energy and combining in its design and construction many unusual features, this important enterprise is an engineering feat of exceptional interest.



General View of Generating Room During Celebration. Chattanooga & Tennessee River Power Company.

The development includes a lock and dam about 40 feet high across the Tennessee River at a point known as Hale's Bar, where at ordinary stages the river is 1,500 feet wide. This development is of especial interest since it inaugurated a new policy in government dealings with inland waterways. It is the first case where a private company was permitted to construct a dam across a large navigable river and where river improvement and power development was combined. The development on the Mississippi River at Keokuk, Iowa, and those in Alabama are other and later examples. Work was started on the project in October of 1905 and its completion was auspiciously celebrated on November 13, 1913, in the presence of a large and distinguished gathering of men prominent in civic, industrial and engineering circles. An account of this celebration appears elsewhere in this issue.

On April 26, 1904, Congress passed an act authorizing the Secretary of War to grant permission to the City of Chattanooga to build a lock and dam on the Tennessee River at a point known as Scott's Point. The city, however, did not take up this franchise and a further clause of the act provided that the Secretary of War should be empowered to offer the franchise to private citizens of Chattanooga. C. E. James and the late J. C. Guild forthwith took up the grant and with the late A. N. Brady organized the Chattanooga & Tennessee River Power Company and entered into a contract with the United States Government for the construction and maintenance of the work.

Investigations were at once made which led to the conclusion that Scott's Point was not a favorable site for the power development nor for improving navigation, on account of the fact that the location of a dam at this point would not give sufficient improvement to the river nor sufficient water power due to the backing up of the tail water at the higher stages of flow. Authorization was finally ob-

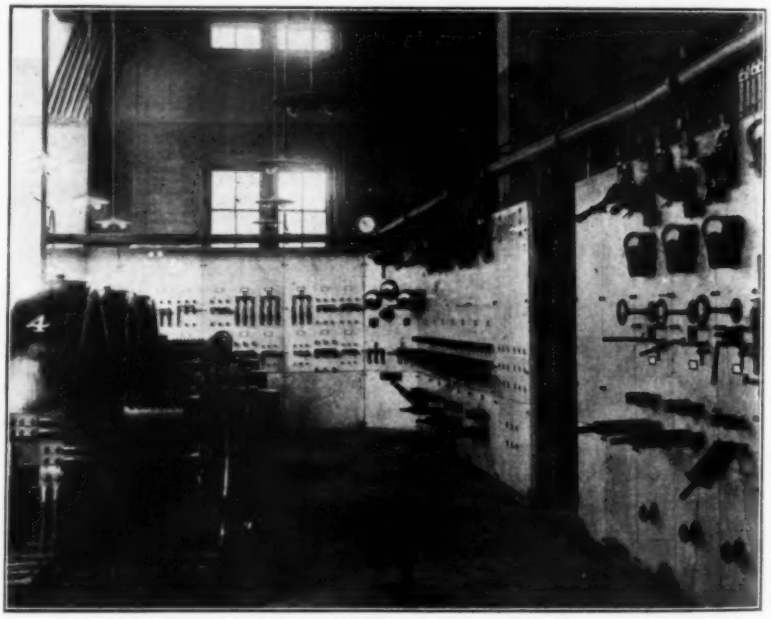
tained for the locating of the dam at Hale's Bar, 33 miles below Chattanooga, where solid rock was available for the dam foundation and the flood plane widened out to such an extent that a rapid rise of the tail water would not be so disastrous to power development. At this point the head on the turbines is about 39 feet at low water, while at a 40-foot stage of the river the backing up of the tail water reduces this head to about 19 feet.

The building of the dam has been attended with difficulties which would have daunted many an engineer. Preliminary explorations of the river bed by means of drilling had shown apparently solid rock under a blanket of sand and gravel from eight to ten feet thick. The bedrock is Bangor limestone, lying in nearly level strata. In October, 1905, excavation was begun at the site of the powerhouse, the foundation for which was carried down 75 feet below the original surface of the ground, 35 feet into limestone rock. It was necessary to inclose the excavated area within a cofferdam on the river side. But, although it was an easy matter to make the cofferdam watertight, it was found, when the inclosed space came to be unwatered, that great quantities of water spurted up from fissures in the bedrock itself. This condition proved to be very disconcerting. Before foundation could be laid it was absolutely essential that these fissures be closed and a perfect water seal be effected.

After considerable experimentation the only practicable method of accomplishing this was found to be by grouting. Numerous six-inch holes were drilled to depths varying from 30 to 50 feet (measured from the bottom of the excavation, which itself had been carried down 35 feet into bedrock). Long pipes were then sealed into the upper ends of the holes, the pipes reaching upward to a height somewhat above the water level of the river itself. When it was thought that a sufficient number of holes had been thus prepared, the cofferdam was flooded to a level slightly above the river level, and the process of grouting was begun. Dry cement was forced under pressure down each of the pipes until it would take no more. After a lapse of a few hours the coffer was again unwatered and, if found necessary, more holes were sunk and the process repeated. This process was a tedious and difficult one, and in thus preparing for the powerhouse foundation alone 25,000 bags of cement were used.

The explanation of this fissured condition of the bedrock is comparatively simple. The Bangor limestone is slightly soluble in the river water, and in the course of ages the water has, therefore, eaten its way into the solid rock, following lines of greatest solubility and forming crevices and cavities and filling them with silt, sand and clay. Had a geological exploration been made, this condition would very probably have been foretold.

General View of Power Station and Dam.



Exciters and Switchboard in Main Station.

When it came to building the dam itself the same conditions were encountered. When a section was cofferdammed and the cofferdam was unwatered, water gushed up from the bottom. In one instance the course of the water from one cofferdam standing full of water to another that had been emptied was traced by the interesting device of coloring the water in the former with potassium permanganate. The fountains in the second cofferdam straightway showed the purple color. This connection was fully grouted. Some of the fissures discharged over twenty million gallons of water a day and all of this water had, of course, to be handled by

pumps until the fissures could be closed by grouting.

Upward of 200,000 bags of cement have been used in thus manufacturing "solid rock" upon which the foundation of the dam might be easily laid.

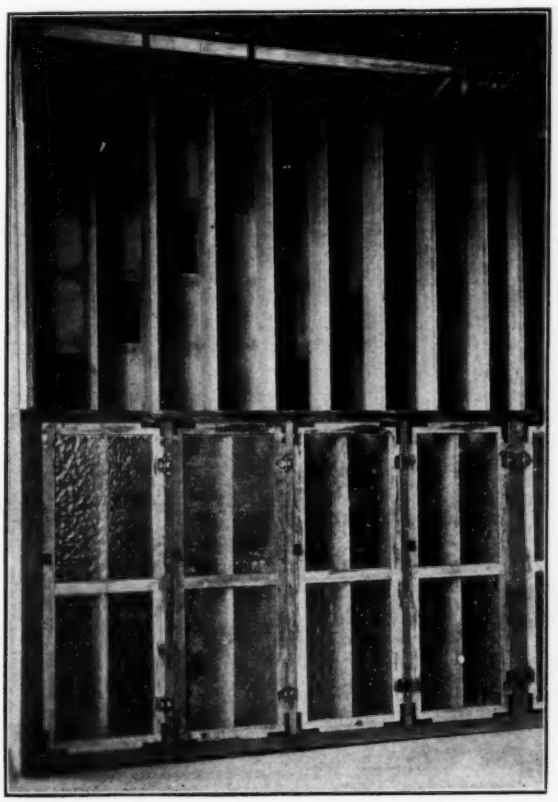
Lock and Dam.

The Government lock, which is situated on the west or right bank of the river, is built against a rock bluff, and has a clear width of 60 feet and is approximately 310 feet long inside. The gates are of the mitering type horizontally framed, built of steel and operated by electricity. These gates are somewhat remarkable for the head apparatus bringing the elevation of the crest up to 639 feet being provided. There is a passage way through the dam in which the electric conduits are carried from one side of the river to the other. In the power house a sluiceway is provided to supply water to the lower pool, at times when none is passing over the dam or through the powerhouse.

Power Station.

Built of reinforced concrete, the power house is an imposing structure. Its artistic, architectural treatment is admirable, utility being the keynote of the design.

Substation at Chattanooga.



Concrete Compartments in Substation.

which they have to support, the difference in elevation between the two pools being about 40 feet; each lift of the lower gates will be 34 feet long, 59 feet high and will weigh 129 tons. The upper gate was built by the Baltimore Bridge Company, of Beaver Falls, Pa.

The lock chamber is filled by two culverts 11 feet by 6 feet, operated by stone sluice gates fitted for electric operation.

The dam itself is 1,200 feet long and extends from the lock on the west side of the river to the power house and transformer house on the east side. The crest of the dam has an elevation of 636 feet, a flash board

The power station building is 66 feet wide by 353 feet long, and in two sections, consisting of an operating building one story high, 220 feet long, and a switch and transformer house three stories high and 133 feet long. This operating building consists of seven bays, each containing two turbine units, making a total of fourteen. Each unit consists of three S. Morgan Smith turbines mounted on a vertical shaft with a generator at its upper end. Each generator has a capacity of 3,133 kilowatts, making a total capacity of 43,862 kilowatts for the station. Under ordinary stages of the river only two of the turbines will be used for each, the third being held in reserve and used when there is a large quantity of water flowing, but giving a reduced head due to back water in the tail race. The two lower turbine wheels are 72 inches in diameter, and the upper wheel 65 inches in diameter. The turbines run at 112.5 revolutions per minute. Each unit is capable of delivering 5,250 horsepower with a head of 35 feet.

The operating building rests practically on the east end of the dam and is carried down to solid rock. The switch and transformer house is supported by round concrete piers carried down to solid rock. The piers were placed by means of light sheet-steel caissons sunk through the earth to solid rock, the earth being excavated as the caissons were sunk; the steel-frame structures, with concrete the concrete piers being proportioned so as to stand the entire load without any assistance from the light steel shell.

The operating building and the switch and transformer house are steel-frame structures, with concrete walls. The main floor of the transformer house is composed of reinforced concrete and the upper floors and the roof of the transformer house and the roof of the operating building are built of flat concrete arches set between steel beams. An electric

traveling crane of thirty tons capacity is provided to handle the generators and turbines in the operating room, and a gantry crane is placed on the up-stream side of the operating building to handle the head gates.

Electrical Equipment.

The generating station is laid out to accommodate 14 alternating-current generators, six exciters, one exciter switchboard, one alternating-current lighting and power board, one alternating-current control board, 14 alternating-current generator field rheostats, one storage battery, six step-down transformers, 15 step-up transformers, 29 6,600-volt H3 oil circuit-breakers and fuses, ten 45,000-volt H3 breakers and buses, three sets of multiplex lightning arresters and choke coils, and three sets of electrolytic lightning arresters and horn arresters.

The 14 alternating-current generators are located on the main floor of the operating room, arranged in two rows, seven in each row. Each generator is of 3,133 kilowatt capacity, three-phase, 60 cycles, 6,600 volts, 112.5 revolutions a minute, and is mounted on a vertical shaft which is driven by three water wheels. At present there have been installed only ten generators, two of which have a 100-kilowatt exciter, mounted on the shaft. On the main floor of the operating room, near the switchboard, are located the other four exciters, each consisting of a 250-kilowatt, 250-volt, 720-revolutions-per-minute direct-current generator, driven by a 375-horsepower, 220-volt, 720-revolutions-per-minute, three-phase induction motor, both the generator and motor being mounted upon a common base and coupled together. On the same floor, close to the motor exciters, is located the exciter switchboard and the alternating-current light and power board.

At the extreme eastern end of the main floor of the operating room are located six step-down transformers, each of 300 kilowatts capacity, three-phase, 60 cycles, 6,600-230 volts, oil cooled. These step-down transformers are located in back of the alternating-current light and power board, but are separated from it by a fireproof enclosure. At present only five step-down transformers have been installed, three of which will furnish alternating current to the exciter motors and two will furnish current for station lighting and power. Above the exciter board and the step-down transformers is a gallery on which is located the main alternating-current 6,600 and 44,000-volt control switchboard from which are also operated the alternating-current-generator field rheostats located in rear of the board.

From each of the alternating-current generators three single-conductor cables are run in fiber conduits, laid in concrete, to the generator oil circuit-breakers, and generator buses which are located in the north part of the first floor of the transformer house divided from the operating house by a 12-inch concrete wall. The 15 step-up transformers are grouped in five sets, three transformers to each set, each transformer being 3,133 kilowatts capacity, high-tension side 25,400-44,000, low tension 6,600 volts, 60 cycles, single-phase, water-cooled. At present only three sets have been installed.

The 4,400-volt current from the step-up transformers is transmitted through oil circuit-breakers to the 45,000-volt buses which are located partly on the second and partly on the third floor in the transformer house. On the third floor are also located the 44,000-volt multiplex lightning arresters. From the 45,000-volt buses the current is sent through two oil circuit-breakers and choke coils up to the roof, where connections are made with the two transmission lines carried on a steel tower built on the roof. The ends of each line are connected to horn arresters, which are located on top of a narrow house, or inclosure, built on the roof. From the horn arresters connections are run through "roof-entrance" type insulators to the electrolytic arresters, four to one line, which are located in the above inclosure. There is a provision made for a third emergency transmission line which will not be installed at the present time.

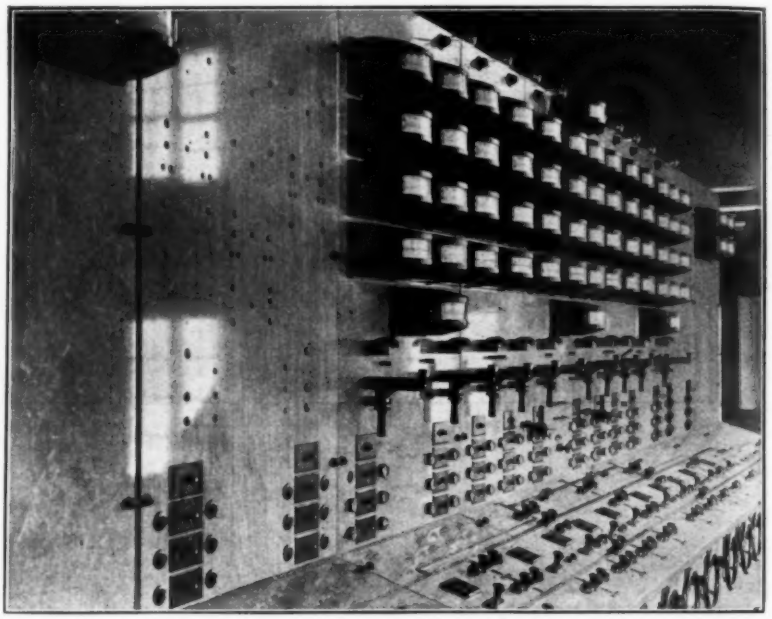
All the H-3 oil circuit-breakers and buses, both 6,600 and 44,000 volts, are installed in compartments built of reinforced concrete.

Transmission Line.

The transmission lines leave the generating station on top of the roof at almost a right angle to the long side of the building, are carried to the substation on 175 steel towers, exclusive of the two steel towers, one on top of the generating station and a similar tower on top of the substation.

The pins which support the large line insulators are of malleable iron, and are designed to withstand a horizontal strain of 6,000 pounds. The strain insulators were furnished by the Ohio Brass Company, and the line insulators by the New Lexington Company and R. Thomas Sons Company. The transmission line follows, the greater part of its route, the tracks of the Nashville, Chattanooga and St. Louis Railroad, crossing them in six places. After going in an easterly direction about two-thirds of its total length, it turns sharply north and continues in that direction until it reaches a point on the river near Moccasin bend, where it turns northeast, crossing the Tennessee River at Moccasin bend, and crossing the Tennessee River for the second time, enters the City of Chattanooga at the foot of Henry Street. From the foot of Henry Street the transmission line follows an easterly course parallel with Henry Street over the company's private right of way, until it reaches the substation at the northwest corner of Henry and Carter Streets.

There are two transmission lines



Control Board and Instruments.

carried on steel towers, each tower carrying two lines, and each line consisting of three No. 000 bare copper cables, which are used on the whole distance of 17.5 miles, with the exception of the two crossings over the Tennessee River, where 350,000-circular mil bare copper cable is used. On the top of the transmission towers a steel cable clamped to the steel structures with cast-iron clamps is carried throughout the whole distance from the generating station to the substation, with the exception of the two crossings over the Tennessee River. This steel cable is used as a ground wire. The steel towers vary in height, 35-foot, 40-foot, 45-foot and 60-foot towers being used for ordinary spans and 150-foot and 170-foot towers being used for the river crossings. Between the foot of Henry Street and the substation the transmission line crosses the Nashville, Chattanooga & St. Louis Railroad tracks, and at each side of this crossing is erected a 60-foot tower on concrete base, 5 feet high above the ground.

All the towers are erected on concrete foundations. On account of the mountainous character of the country, it was not possible to have the towers located at equal distances, and, therefore, the spans vary between 200 and 700 feet, and in one instance the span being as short as 150 feet. The spans over the Tennessee River are 1,400 feet and 1,500 feet, respectively.

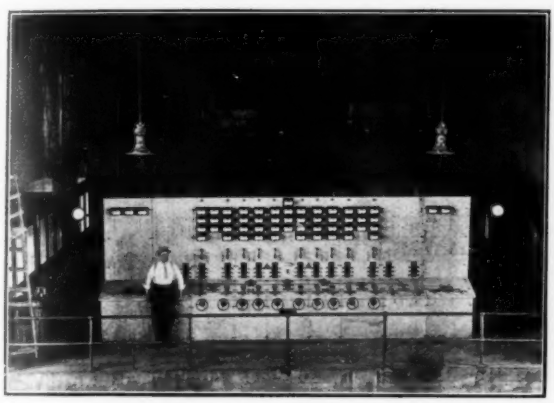
Substation.

The substation is a three-story and basement building 69 feet 10 inches long, 55 feet 4 inches wide, and 81 feet one inch high from the ground, the basement being 15 feet deep, and accommodates two sets of electrolytic lightning arresters and horn arresters, two sets of multiple lightning arresters, and choke coils, five 40-000-volt H3 oil circuit-breakers and buses, three 4,000-volt H3 oil current-breakers and buses, one 40,000-volt control board, two 4,000-2,300-volt control boards, ten 2,300-volt outgoing lighting feeders, 14 4,000-volt outgoing power feeders, one station alternating-current light and power board, one motor-generator set, three 2,300-115-volt oil-cooled step-down transformers for station light and power, one storage battery, and nine 40,000-4,000-volt main step-down transformers. With the exception of the storage battery, all apparatus is of General Electric manufacture.

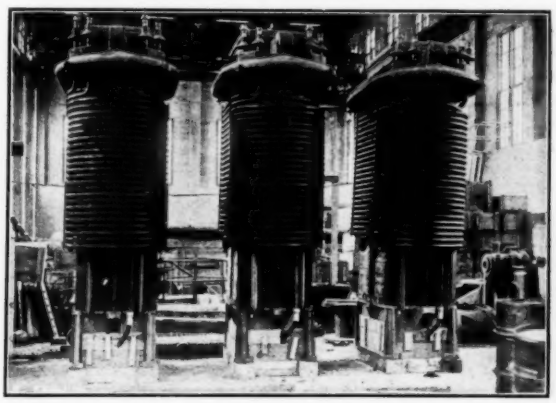
The principal arrangement of the apparatus is similar to that in the generating station. On top of the roof of the substation is a steel tower on which are supported the two transmission lines, which enter the building through an inclosure built on the roof, and through large openings in the roof enter the southern part of the third floor, where the 40,000-volt oil circuit-breakers and buses are located. On this floor, near the southern wall, are also installed the multiplex lightning arresters. The ends of each line are connected to horn arresters, which are located on top of the inclosure, built on the roof. From the horn arresters connections are run through "roof entrance" type insulators to the electrolytic arresters, four to each line, which are located in the above inclosure.

From the buses, on the third floor, copper connections lead down to the southern part of the second floor, where two 40,000-volt transformer oil circuit-breakers are located, and from which cables are run in fiber conduits to two banks of large step-down transformers, located in the middle part of the first (main) floor. There are three large compartments built each to accommodate three 3,133-kilowatt, water-cooled, single-phase, 60-cycle, 40,000-4,000-volt transformers. At the present time only two sets of transformers, two in a set, are installed. From the step-down transformers the 4,000-volt current is carried through large cables in fiber conduits, built in concrete walls, up to the northern part of the third floor, where the 4,000-volt transformer oil circuit-breakers and buses are located. From these buses leads are run upward to K4 automatic switches, which are mounted in the rear of the 4,000-2,300-volt board, located on a gallery called the third mezzanine floor. From this board circuits are run through choke coils out of the building, connections being made with multiplex lightning arresters, before leaving the building.

On the third mezzanine are located the main alternating-current control board, from which are controlled all 40,000-volt and 4,000-volt H3 oil circuit-breakers, one motor-generator set, station light and power board, and three step-down transformers. The motor-generator set consists of a 10-kilowatt, 120-volt direct-current generator, direct connected to a 150-horsepower, 115-volt, three-phase induction motor. This motor-generator will furnish the direct current for operating the oil circuit-breakers, but will be also used for charging the storage battery, which is located in the basement. Each of the three step-down transformers is 40 kilowatts, single-phase, 2,300-115 volts, oil-cooled.



Bench Board on Power-House Gallery.



Bank of Transformers in Power Station.

At present all outgoing 4,000 and 2,300-volt leads will leave the building on the level with the third floor and will be supported on wooden poles erected on the sidewalks. Provision is made for carrying the outgoing feeders in underground ducts, and for this purpose fiber conduits are built in the northern building wall and leave the same a short distance below the grade, being provided with fiber caps.

The designs for the water power plant were made by John Bogart, consulting engineer of the Chattanooga & Tennessee River Power Company, while the mechanical and electrical designs were perfected by T. E. Murray, consulting engineer for Mr. Brady. B. T. Burt, to whom we are indebted for the information contained herein, acted as resident manager during the construction of the plant and has subsequently been made general manager of the company.

Commercial Practice
Management, Rates, New Business

An Emergency Installation of Electric Service.

A good example of promptness on the part of both the central station and the electrical contractor in providing electrical service for a disabled plant is given by the New England Cotton Yarn Company at New Bedford, Mass.

On November 4, at 12:40 p. m., the 750-horsepower Corliss cross-compound engine which supplies power to the plant was wrecked through the cross blocks which supported the shaft giving way. The company decided that it was a propitious time to install electric service and on the following morning orders were given to Buckley and Company to wire the factory and install eight three-phase, 60-cycle 500-volt electric motors aggregating 650 horsepower. The lighting system, which was a two-wire, 110-volt, direct-current layout, was to be changed to a three-wire, 110-volt alternating.

Work was started the same evening at 7 o'clock and continued night and day until completion. By 3 a. m. on Thursday one floor and part of a second were ready for operation and by 3 o'clock the same afternoon another floor was running. By 6 p. m. Friday the lighting system was completed and another floor of the factory ready for operation. On Sunday the entire installation was completed and tested out and when the factory opened on Monday morning everything was in working order.

In the mean time the New Bedford Gas & Edison Light Company had installed the service connections, which required a bank of eight transformers.

In making this installation there was used over a ton of wire in sizes from No. 6 to 300,000 circular mils. This wire was made by the Phillips Insulated Wire Company, of Pawtucket, R. I., and was furnished on short notice by the Wetmore-Savage Company, of Boston.

The installation of this service prevented a complete shutdown of the plant for some weeks, which would have involved about 1,100 operatives. It is to be noted also that an aggregate motor capacity of 650 horsepower was sufficient to replace the 750-horsepower engine.

Avoid the Smokestack in Electric-Sign Location.

The accompanying photograph of a large electric sign recently erected on the roof of an Eastern hotel carries a lesson which should be taken to heart by central stations, sign manufacturers and contractors responsible for this class of installations. The sign is 60 feet long, with letters 12 feet high, and contains about 500 10-watt tungsten lamps set in front of enameled reflectors. It is supplied with energy from the local lighting plant of the hotel, and its effectiveness has been greatly decreased since installation by the unfortunate location of the smokestack outlet within a few feet of the head of the sign. Nearly half the sign has been so much blackened, as illustrated in the half-tone, that its legibility at a distance has been seriously reduced. Prior to the blackening shown the sign could be seen and recognized at a distance of from 3 to 5 miles, depending upon the weather. It is within a few hundred feet of a railroad trunk line entering the city and is one of the largest in-

Improperly Located Electric Sign.

stallations of its kind in the vicinity. The obvious moral is the re-location of the stack outlet, the removal of the sign to a point on the left-hand section of the roof, or central-station service, with reduced boiler requirements and lessened draft.

Lighted Way in Brookline.

The fashionable Boston suburb of Brookline has inaugurated an improved street lighting system. On Monday, November 3, the initial illumination of "Lighted Way," as the new installation is called, was celebrated. This installation is but the beginning of a general improvement in public lighting, and consists of 45 6.6-ampere luminous-arc lamps, of about 1,000 candlepower each and consuming 510 watts. The units are erected on ornamental wooden poles, 17 feet in height, painted green, with iron base, and closely simulating metal structures, which, however, are not permitted in Brookline, by a town ordinance.

The lamps are of the General Electric type, and replace nine magnetite arc lamps of 800 candlepower and 5 large Welsbach gas lamps, besides a number of small gas units. The installation was done by the Boston Edison Company, which furnishes energy for the electric lighting under contract with the town, the company owning all apparatus. The streets lighted are Washington Street from the Boston line to Harvard Street, and Harvard Street from Harvard Square to School Street. It is planned to extend the improved system over other portions of the town with first attention to the Coolidge Corner and Washington Square business centers.

City Contract in Portland.

The Portland Railway, Light and Power Company, after competitive bidding, has been awarded a contract for lighting the streets of Portland, Ore., for a period of three years beginning January 1, 1914. The company recently completed the installation of a 10,000-horsepower turbine, giving a total generating capacity of 90,000 horsepower. Twelve cities and towns in Oregon and Washington, having a total population of approximately 300,000, are now being supplied by the company.

Street and Sign Lighting in Louisville.

With approximately 750 ornamental lighting standards, supplementing the regular street lighting, and over 1,000 electric signs installed on various buildings, the business section of Louisville, Ky., from the electrical advertising viewpoint at least, may well be considered to exemplify the high standard which all progressive cities are striving to reach.

Sometime ago a start was made to interest the merchants of downtown Louisville in the advertising value of ornamental street lighting. Through the initiative of the Federal Sign System (Electric) a comprehensive plan was inaugurated whereby business men in sympathy with the movement could have such lighting equipment installed in front of their establishments at a nominal flat rate per month for the service. Once a start was made the merchants soon realized the advantages accruing, and from a modest beginning a general campaign was started, covering the entire business district, which has resulted in the installation of over 700 posts on the principal thoroughfares of the city. In many sections the merchants were unanimously in favor of such ornamental lighting, the result being uniform systems with uniformly spaced posts in these districts.

The Federal company, as the pioneer in this work in Louisville, has continued its activities, recently with the added co-operation and support of the local central station. All work of soliciting, billing, collecting, installing and operating the system, is handled by the company, current being purchased from the Louisville Gas & Electric Company.

Contracts are made for a period of five years or more, the signer being a land owner or tenant having a long-term lease. A flat rate of $2.00 per front foot per week is maintained for lighting in the business district and $1.75 per post per week for outlying installations. All lamps burn every night from dusk to midnight.

In the business district 14 posts are installed on each block, seven on each side of the street. Blocks are approximately 420 feet long, making the spacing between posts about 70 feet. The posts are of massive construction, simple in design and are secured to four bolts embedded in concrete. The Southern Foundry Company, of Owensboro, Ky., supply all posts used.

It has been the experience of the company that where posts are rigidly secured they break when run into by a wagon or automobile, as frequently happens, and are a total loss. In case of such accident, with the method now used, namely bolting the posts, the bolts give way, allowing the post to fall without damage, except to the glassware.

Feeders for the lighting system are run from suitable locations in each block and from this point are carried in conduit along the curbing to each of the other posts. A controlling switch caring for seven posts is located in the base of the posts where the service feeder enters. A meter is usually installed in the customer's premises where the street-lighting connection is made.

Each post is equipped with four 60-watt vertical pendant lamps and one 100-watt vertical upright. Alba inclosing globes are used. Lamps are of General Incandescent make, 110 volts, and wired on the three-wire multiple system. The distance from the sidewalk to the top of the center globe is 13 feet. Fig. 1 is a night view of Market Street, showing the appearance of this installation.

The advances that have been made in Louisville in sign, window and outline lighting are also due, in a large measure, to the activities of the Federal company working in friendly competition with the central station. Sign and window lighting is furnished on a flat-rate basis, which includes all maintenance and lamp renewals. The Louisville Gas & Electric Company bills the Federal company, which in turn collects from the customer. There are at present over 1,000 electric signs installed and new customers are being secured at a rapid rate. Mazda lamps of 5 or 10 watts are used exclusively.

The sign ordinance in force in Louisville contains some very unique provisions and, while favorable to electric signs, actually prohibiting the use of any other, militates to some extent against some of the newer types of signs. One clause states that every sign shall have one visible lamp for every 1.25 square feet of each side of the sign surface and no sign shall be allowed which has a total of less than 20 lamps of four candlepower each.

Fig. 1.—Market Street, Louisville, Ky., Showing Ornamental Lighting Posts.

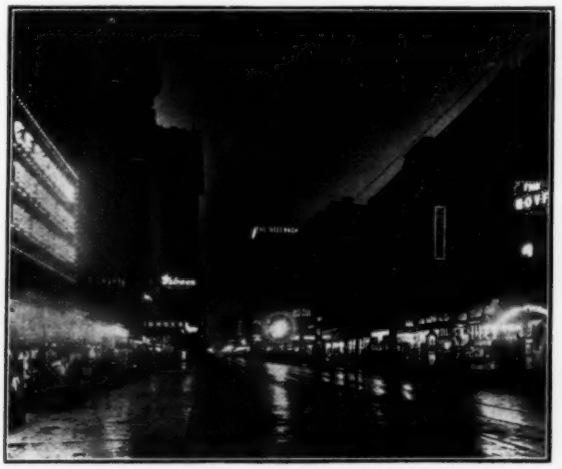


Fig. 2.—Fourth Street, Louisville, Showing Extent of Sign and Window Lighting.

Business Increase of Interstate Light & Power Company.

The Interstate Light & Power Company, a subsidiary of the Consumers Power Company of Minnesota, serving the lead and zinc mining fields of Southwestern Wisconsin has increased its electric load 81 per cent since 1910 when the present interests acquired the property. The output of the company is now in excess of 225,000 kilowatt-hours a week. The generating capacity of the company has been increased, recently, from 3,000 to 5,000 horsepower.

Electrical Construction

AN INTERESTING INSTALLATION OF EXPOSED-CONDUIT WIRING.

Notes on the Wiring in a Large Printing Plant.

The building in which the electrical work that this article undertakes to describe is installed is a modern fireproof structure, consisting of a basement and two main floors. It is used as a printing plant, and the equipment is thoroughly modern and complete in every particular. Direct-current electric motors are employed in the driving of all the presses and other machinery, and the lighting is done by means of mercury-vapor lamps and standard incandescent units.

The task before the consulting engineer who designed the installation and the electrical contractors who put in the work consisted in setting and connecting up the motors, installing all the lamps necessary for proper and efficient illumination of the place, and providing a complete system of wiring for motors and lamps. While there was no disposition to waste money in this plant, it was understood that only high-grade material and the best that could be had in the way of construction would be satisfactory.

General Notes on the Electrical Work.

All the wiring was installed in rigid metal conduit, Pittsburgh Standard conduit being used. For the most part, the conduit work was run exposed. Where installed on the ceiling, the conduits were run, as far as this was practicable, along lines parallel with the main axis of the building or along lines at right angles thereto. The pipes were fastened to the ceilings in a neat, substantial way. The methods of support are brought out rather clearly in some of the accompanying illustrations; and they are gone into in some detail in a later portion of this article.

At junctions of two or more runs of conduit either standard pull-boxes or condulet fittings were installed. Especial care was exercised to make all the joints in the conduit work thoroughly tight. Wherever conduits were laid in concrete white lead was used in making the joints. All metal boxes used in the installation were painted inside and out with asphaltum paint.

The copper, current-carrying parts of all switches were designed on a basis of 1,000 amperes per square inch of cross-section and 75 amperes per square inch of contact surface.

All fuses in the mains and branches of motor-circuit cutout cabinets and in the motor-switch cabinets are of the standard cartridge-inclosed type. The fuse cutout was so designed, however, that open-link fuses may be installed if this is ever desired. The main fuses in lighting cabinets are likewise of the standard inclosed type, but the branch-circuit fuses are plug fuses, as is generally the case.

Wherever the consulting engineer or the contractor deemed the standard lugs supplied on any appliance or device insufficient for the best possible installation of the wires, the contractor

Fig. 1.—Front View of Service Board Showing Portions of the Conduits Through Which the Feeders are Carried From the Feeder Panel to the Pull-Box on the Ceiling.

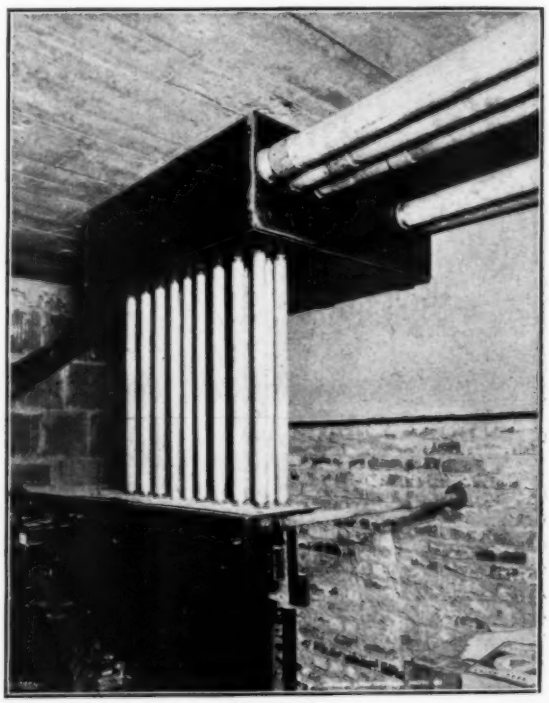


Fig. 2.—View Showing Pull-Box on Ceiling, Short Conduits that Connect Feeder Panel of Service Board with Pull-Box, and Portions of Large Feeder Conduits.

provided lugs of a kind considered more suitable.

Double-braid rubber-covered wire was used throughout the installation, of course. If the conductor was larger than No. 8 B & S gauge, stranded wire was used. No joints for the purpose of making wires longer were permitted, and where joints were made in taking off taps the joint was carefully soldered, then taped with Okonite rubber tape, and finally given a covering of friction tape carefully applied.

Wires were not allowed to be pulled into any conduits until the concrete was thoroughly dry.

All wooden blocks used to support cabinets, conduits or other electrical work, and any other material similarly employed, was painted black, with asphaltum paint.

Layout of Circuits.

Fig. 3 shows the arrangement of feeder conduits and indicates the approximate locations of the various centers of distribution of circuits to lamps and motors. There are three main distributing centers for the motor service. In the figure just referred to these cabinets are marked *B. E. P.*, *1-E. P.* and *1-W. P.*, respectively. The other cabinets shown are for the lighting system.

The electric service enters at the northeast corner of the basement, where the main service board is installed—see lower right-hand corner of Fig. 3—and from here the several lighting and power feeders extend to the distributing centers that they serve in the manner made clear in the diagram. The motor for operating the elevator is located in the pent house on the top of the building; the diagram shows the feeder for the elevator motor.

As has been intimated already, the electric service is direct current. The current is taken from the lines of the Commonwealth Edison Company, by

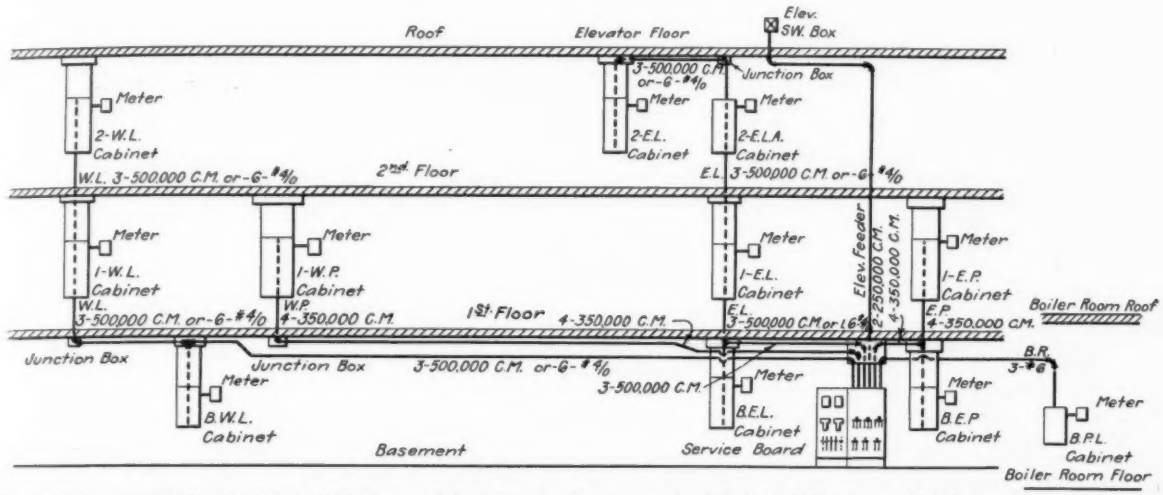


Fig. 3—Diagram Showing Positions of Feeders and Approximate Arrangement of Cutout Cabinets on Lighting and Power Systems.

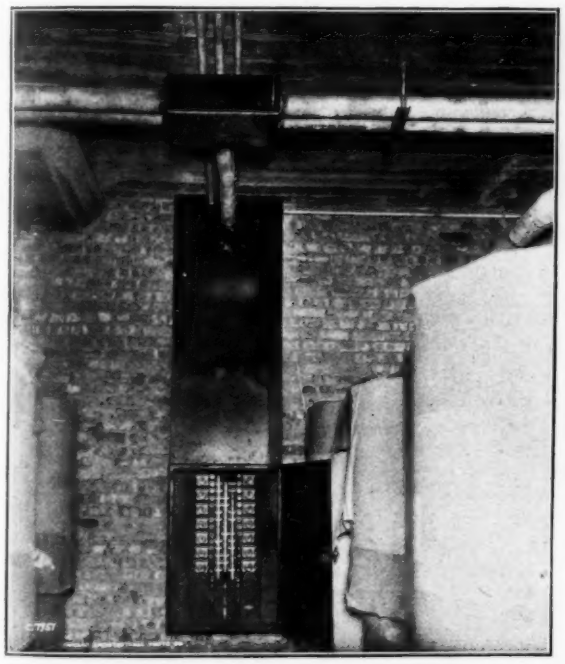


Fig. 4.—One of the Basement Cutout Cabinets—Conduits and Small Pull-Box Shown on Ceiling.

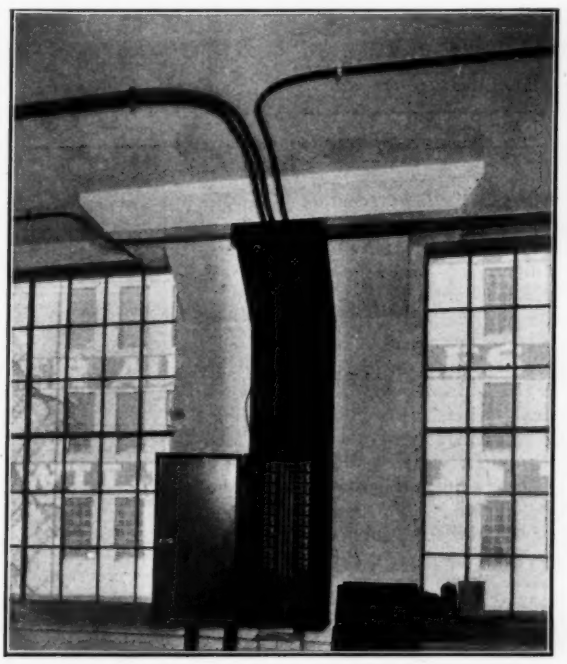


Fig. 5.—View Showing Interior of Wiring Space that is Provided Above All Fuse and Switch Panels.

means of a three-wire connection, 230 volts pressure being thus supplied for motor operation and 115 volts for the lamps.

The Service Board.

One of the accompanying figures shows the front of the service board. This is a two-panel board made of 1.5-inch slate and an angle-iron frame. Being the one to which the service from the outside mains is brought in, the left-hand panel has the main service switch mounted on the front of it, and above this switch the meters of the company that supplies the current are located. On the rear of this panel the main service fuses are installed. Since these are open-link fuses, they are placed in an approved metal cabinet or box. The feeder panel is equipped with six fused knife switches, the three at the bottom of the board being two-pole units for motor service and the others three-pole switches for the lighting feeders. It is thus seen that the lighting supply is kept separate from the power circuits from the service board on, an arrangement that is exceedingly important where good, steady illumination must be had.

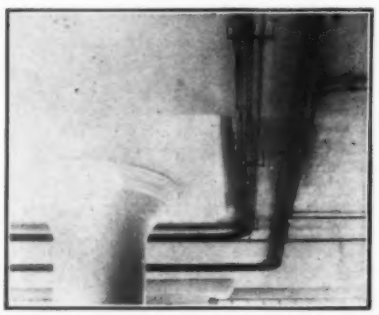


Fig. 6.—Runs of Conduits on Concrete Ceiling.

On the rear of the service board connections are made to the feeder switches from a set of busbars that are energized from the service switch, which busbars, as well as the copper-bar connections from them to the feeder switches, were designed on a basis of 1,000 amperes per square inch of cross-section. The conductors that connect the busbars to the service switch have a current-carrying capacity equal to that of the switch itself. Space was left on the service board for adding other busbars, these to be installed whenever the growth of the printing plant makes them desirable.

From the feeder switches connections are carried to terminal racks for the feeders, and from here conduits run to a large pull-box installed on the ceiling over the service board, and shown in Fig. 2. It will be noted that there are several times as many conduits between feeder panel and pull-box as there are feeder switches and feeder circuits. This is due to the fact that between these two points a conduit is provided for each individual conductor. Such an arrangement made it possible to bring every conductor straight down to its proper terminal, without the necessity of carrying it to one side or the other to make the connection.

The pull-box just referred to was made of No. 10 U. S. gauge sheet steel; it has a hinged door that makes the interior accessible, and is large enough to accommodate other feeders whenever additional feeders may become necessary. It is doubtless understood already that the short conduits from the service board, and the larger ones that extend to the right with the feeders in them, as well, enter the pull-box through knockout openings and are fastened to the walls of it by means of locknuts and bushings of the standard type. There are knockouts in the walls of the box for other pipes in addition to those now in use.

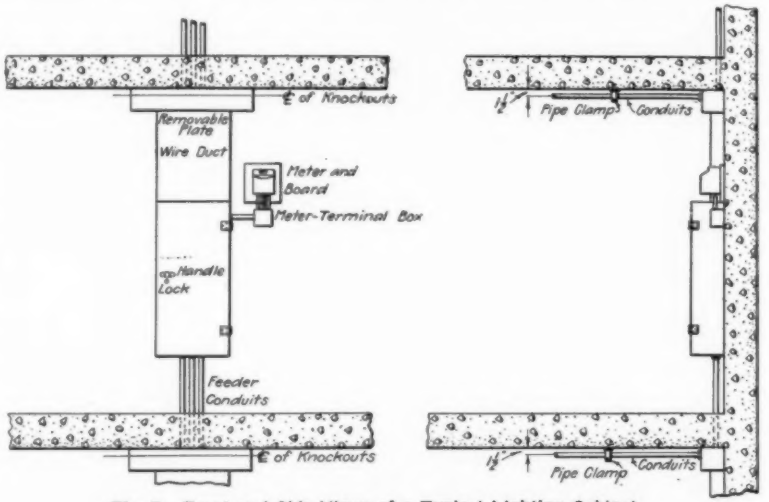


Fig. 7.—Front and Side Views of a Typical Lighting Cabinet.

Panel-Boards and Cabinets.

Fig. 7 shows front and side views of a panel-board cabinet of the kind employed in the installation under consideration. The construction is further illustrated in Figs. 4 and 5. A particularly interesting feature of these cabinets is the metal-box extension which reaches from the top of the cabinet proper all the way up to the ceiling. The front of this box is removable, and thus the interior of the wiring space that the box provides

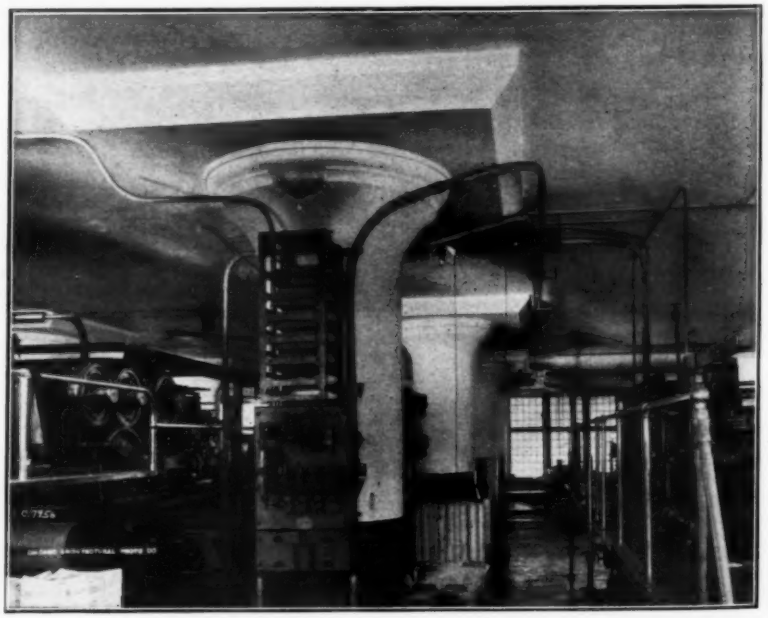


Fig. 8.—Conduit Work and Motor-Control Equipment.

is made accessible. This interior is shown in the upper half of Fig. 5.

These cabinets are of the so-called surface type. They are made of sheet steel, and have angle-iron corners. None of the sheet metal is lighter than No. 10 U. S. gauge. On each side of the slate panel-board there is provided a removable piece of slate four inches wide and of the same thickness and length as the panel, and this is arranged so as to afford access to the wiring pockets. The panel-boards are made of the best grade of enameled slate, with plain-finish copper mounting. The lighting panels are arranged, of course, for three-wire mains and two-wire branches.

In matters of general design the power cabinets are similar to those employed in the lighting circuits.

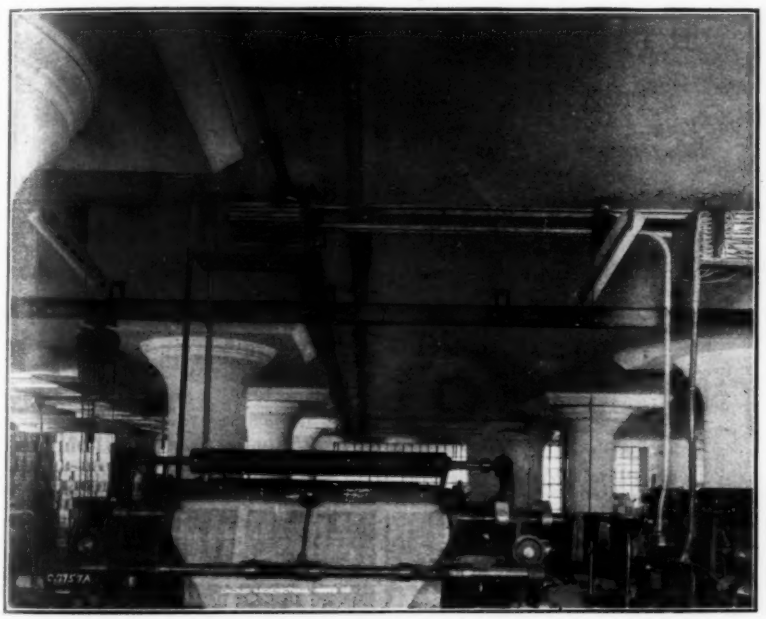


Fig. 9.—Conduit Work, Lamps and Motor Resistances on Ceiling.

Meter loops are provided at both lighting and power cabinets, the plan being to provide for measuring the energy consumption in each department of the printing plant separately. These loops are carried out in conduit to meter-loop terminal blocks or boxes of an approved design. In Chicago, it may be noted in passing, the use of such terminal blocks is required by the electrical inspection rules. The meter boards are made of 1.25-inch pine of convenient width and length, and are painted black with asphaltum paint.

The meters, which had not been installed when the photographs for this article were taken, will be located about six feet from the floor, so that they can be read easily without the use of a ladder.

Method of Supporting Conduits.

Figs. 10 and 11 are illustrative of the methods employed in this installation in fastening runs of exposed conduits on the concrete ceilings.

Fig. 10 shows how the work was done when a long run consisting of a number of parallel pipes was to be carried along close to the concrete surface. Standard iron expansion cases—which can be bought from any one of several manufacturers—were used to fasten light channel irons to the ceiling, the length of the channel iron being placed at right angles to the direction of the conduit run, and to these pipe clamps for the conduits were fastened in the manner shown in the figure.

The expansion case referred to above consists of a sort of hollow split cylinder, whose two halves are held together at the end which will be nearest the surface of the ceiling when the device has been installed by a narrow band of rather elastic metal. The opening along the center of the cylinder is one that gets larger as the end is approached, so that when a bolt is thrust through the expansion case from the opposite end a nut can be placed on the end of it and pulled slightly down into the expansion case without spreading the sides of the case apart. If thereafter the bolt is turned in such a manner as to draw the nut down into the hollow expansion cylinder, the walls of the latter are flared apart. (See Fig. 11).

The foregoing, and a study of Figs. 10 and 11, ought to leave no doubt in the reader's mind as to how the circuits are attached to the ceiling. Perhaps it is well to add, though, that the hole in the concrete surface is usually made somewhat larger as the bottom is approached. It should also be noted that Fig. 11 illustrates the construction employed where the conduits have to be dropped below the ceiling in order to pass below other work, or for any other reason. Here longer bolts, slipped through pieces of pipe, are made use of to support a cross-piece of channel iron, on top of which the conduits rest.

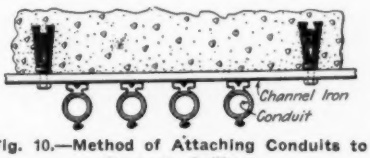


Fig. 10.—Method of Attaching Conduits to Concrete Ceiling.

The expansion-case method of attachment was employed in fastening work to concrete surfaces throughout the installation, whether the work consisted of conduit, pull-boxes, outlet boxes, or of something else. It makes a most substantial job.

Further Notes on the Lighting of the Plant.

It has been pointed out already that both Cooper Hewitt mercury-vapor lamps and standard incandescent units are employed in the illumination of the building with which these notes are concerned. A large part of the lighting on the first and second floors is done with the mercury-vapor unit. The Type P direct-current lamp is used.

For the lighting of the stairways special circuits are provided.

Where drop lamps are installed, No. 18 lamp cord of what is sometimes known as the brewery type is used, and the lamps are dropped from conduit-outlet boxes having covers designed for service of this character. Weatherproof sockets are used for the lamps that light the boiler gauges, and wherever else a socket of this type was considered desirable.

This installation was designed by Charles G. Atkins, consulting electrical and mechanical engineer, of 53 West Jackson Boulevard, Chicago, and the work was installed by the Pierce Electric Company, electrical contractors, of 335 West Madison Street, Chicago.

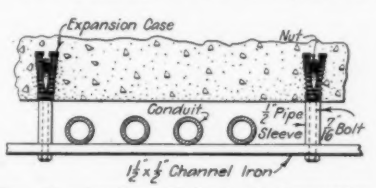


Fig. 11.—Another Method of Supporting Conduits from Ceiling.

Elimination of Single-Braid Wire.

In the November number of *The National Electrical Contractor* there appears a letter from M. K. Foxworthy of Indianapolis, Ind., recommending that the approval of single-braid rubber-covered wire be discontinued. The letter, which was directed to the National Electrical Contractors' Association through Ernest McCleary of Detroit, who is the chairman of the Code Committee, says in part:

"After careful investigation and consideration I find a large number of contractors are in favor of having eliminated from the approved list of materials all single-braid rubber-covered wire and cables larger than No. 16.

"The principal reason is that there is such a slight difference in the price of single and double-braid insulation on the same size wire that it does not justify the additional investment and overhead expenses of carrying the two classes of wire in stock, much less the inconvenience of having, in a great many cases, to furnish both insulations on the same job, thereby making it possible for errors in delivery and in some cases the installation of the wrong wire.

"In some instances it is necessary to make a special purchase of single-braid wire for a job in order to meet competition, when you have in your stock large quantities of the same size wire in double braid.

"I realize that a great number of our members may say that the greater per cent of their business only requires single-braid wire; but if we can have such a ruling made by the Underwriters' Committee it will serve to put all competition on the same footing, and will work a hardship on none.

"You realize, as does every other man in the electrical contracting business, that the multiplicity of attachments and appliances necessary to the handling of this business is such that in eliminating from the market, if possible, articles of the same general make with such slight differences as in the point in question, there should be no hesitancy upon the part of the electrical contractors, inspectors and purchasers doing their part.

"From the talks I have had with the various contractors, both at the Convention and since, I have no hesitancy in saying that I feel that the majority of the members of the Association would favor such a change, and for that reason I would like very much to have you put this matter before the membership and get their expression upon the same, and if it is possible and agreeable to all parties concerned that you take this matter before the Underwriters' Rules Committee and see what can be done with it."

A Good Way to Handle Fixture Wire.

In our shop the fixture wire that we use is kept on reels placed on a piece of iron pipe that is hung from the ceiling by means of wires. The pipe hangs in a horizontal position, of course, and the reels are located over the workbench in the part of the shop kept for fixture work. Figs. 1 and 2 illustrate the construction of the reels and the method of hanging them. They are well out of the way of the workman, but the fixture wire is in easy reach all the time.

The reels are provided with control spacers consisting of short pieces of pipe

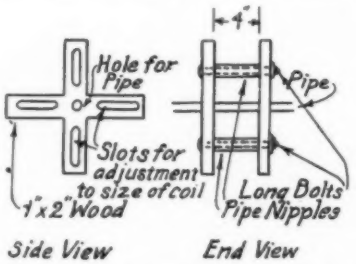


Fig. 1.—Parts of Reel for Holding Coil of Fixture Wire.

slipped over the smaller pipe on which the reels hang and turn. These spacers hold the reels in proper position. As is shown in Fig. 2, a heavy coiled spring fits in between the outer end of one of the reels and a locknut employed as a stop or shoulder. The tension of this spring prevents the reels from paying off too much wire when they have once been set turning.

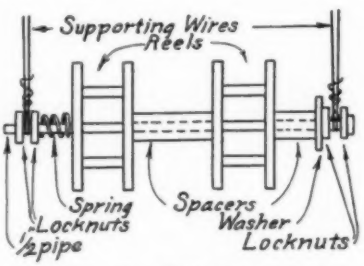


Fig. 2.—Two Reels in Position.

We find the arrangement very convenient and satisfactory.

E. M. Raetz.

The Electrical Contractor and the Society for Electrical Development.

The bimonthly meeting of the Kansas City Electric Club, which was held on November 11, was Electrical Contractors' Day, and the meeting was a successful one.

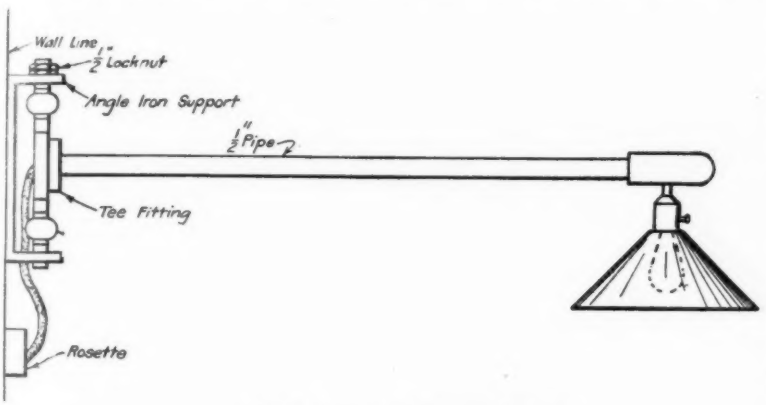
It had been planned to have either J. M. Wakeman or H. H. Cudmore present to speak on the aims and purposes of the Society for Electrical Development; but previous appointments made it impossible for either of these gentlemen to be present, and so their places were taken by J. G. Barrett and A. J. Burns.

Mr. Barrett spoke briefly of the origin of the Society for Electrical Development, told of the efforts at perfecting the organization and of the successfulness of these efforts, and closed with a stirring appeal to those present to get into the game and subscribe to membership in the Society. He was followed by Mr. Burns, who is the secretary of the Missouri Association of Electrical Contractors and also of the Kansas City local association, and who was the presiding officer at this meeting. Mr. Burns told of the work that the Society will undertake, and spoke of the methods of procedure contemplated. He then went on to speak of the advantages the Society offers the electrical contractor. He declared that the contractor ought always to remember that he is in business to promote the use of electricity. The time will come when the contractor will have the same recognition as a business man that the jobber and the manufacturer now enjoy; but before this condition can be attained there must be greater co-operative effort among all the electrical interests. The amount of electrical construction done in Kansas City reaches the half million mark, and is increasing every year; yet the contractors are not making money. If the manufacturers and jobbers are to get what belongs to them, they must have the contractor as a customer, and see that he is enabled to make a profit at his business. That the electrical contracting business of today is not what it should be is evidenced by the feeling of unrest among contractors. The contractor who is a member of the Society for Electrical Development ought never have any trouble getting a sympathetic hearing from the central station; membership itself can usually be taken as evidence of an aggressive disposition to promote the industry. It is hoped that the central stations will, in the near future, discontinue selling at and below cost the various electrical utilities, for which the contractor, to a great extent, depends for his profitable merchandizing, and support him in his endeavors to make it possible for the central station to sell the commodity they are in business to supply. It would seem absurd to state that the contractor cannot take care of the merchandising of electrical appliances, when he has never had a chance to do it at a profit. If the contractor could make enough profit from the contracting business to give his customers electric appliances at cost or less, the central station would go into the wiring busi-

ness, claiming that the contractors were retarding the growth of the electrical business by excessive profits. If the $80,000,000 now spent in competitive effort annually could be expended not in competition, but in a united effort, it would put the electrical business beyond the comprehension of any man. This is the function of the Society for Electrical Development.

A Bracket Lamp with a Long Swing.

The bracket illustrated below is a very convenient one for rugged service in warehouses, factories and other places where there is wanted a bracket lamp that can be swung around over a long arc of large radius. The fittings employed in making it are those that almost any wireman is constantly using. The bracket is supported by means of three pieces of angle iron. The longest piece is drilled for screws which hold



Sketch of Parts of Bracket Fixture.

it on the wall or other surface in a vertical position, as shown, and at each end of this iron a short piece of angle iron is riveted to that edge of the vertical iron which projects away from the wall. Through holes in these short pieces the half-inch conduit nipples, that form parts of the fixture pass. These nipples screw into standard insulating joints, and between the two insulating joints there is a Type T condulet which has a porcelain cover with one hole in it, through which the feed wires pass into the swinging horizontal arm of the fixture.

Locknuts are employed on the ends of the conduit nipples referred to, to hold the fixture in the supporting angle-iron frame. At the end of the bracket that holds the lamp, I use a Type E condulet with a metal cover having a one-eighth-inch male nipple for the socket. A key socket and a metal cone reflector complete the bracket, as I have built it.

M. J. Moriarty.

Among the Contractors.

The Central Electric Company has recently opened an electrical contracting business at 10 South Tennessee Avenue, Atlantic City, N. J.

The A. B. Harris Electric Company, of Gary, Ind., is putting in a large motor installation for the Gary *Evening Post*. This will be one of the largest electrical plants employed in newspaper service in northern Indiana, it is stated.

F. L. Decker, of Chicago, is wiring a new church building in that city for 400 incandescent lamps. Indirect lighting will be employed here. The electrical work in the new Citizens' State Bank, Chicago, is being installed by Mr. Decker also.

John I. Bronson & Company, of Jacksonville, Fla., has the contract to install the electric fixtures in the new Supreme Court Building in Tallahassee.

The Clefton Company, which carries on an electrical contracting business in Owatonna, Minn., has been awarded the contract for the electrical work in the new government building in that city. The job includes the installation of the lighting and fixture equipment and also a complete system of telephone, signal and fire-alarm wiring.

Two of the largest contracts to be awarded within the vicinity of Baltimore, Md., for electrical construction, have been awarded to the Wilson-Malton Electric Company. These were for the wiring of the Administration and the Electro-Mechanical Buildings for the Johns Hopkins University. Plans and specifications for this equipment were prepared by John B. Whitehead, who is professor of electrical engineering at the University, and Charles L. Reader, consulting engineer.

G. A. Siecer, of Jacksonville, Ill., has been awarded the contract by the Board of Education, for the electric wiring and fixtures in the new public school building in Jacksonville.

The Mechanical Electric Company is a new firm of electrical contractors that has located at 411-413 West Thirty-eighth Street, New York City.

The Lehigh Valley Railroad has awarded large contracts for electrical work in its buildings at Manchester, N. Y., to John R. Proctor, 4 East Thirty-third Street, Bayonne, N. J. The work will amount to about $5,000.

The Fitch Electric Company, of Cleveland, O., is wiring a new 16-suite apartment house near Rockefeller Park, in Cleveland. The electrical work will be very elaborate when it has been completed. It will include an automatic elevator, vacuum cleaner systems, telephones, etc. There will be nearly 650 lamp outlets, and the baseboard attachment-plug receptacles will number 148.

The LaFrance Electrical Construction and Supply Company has removed from its former location on Superior Street near the interurban station, Toledo, O., to the new Raitz Building on Jackson Avenue. The concern will have one of the most convenient and handsome sales rooms in Toledo. Among the jobs which this company now has on hand are the following: power and lighting systems for the new plant of the Toledo Rex Spray Company, consisting of two 10-horsepower, three-prase Wagner motors and a factory system of 75 lamps; lighting and power system for the Conde Cloak Company, in Toledo Factories building, consisting of a five-horsepower motor and 40 100-watt lamps; Owen Silica Sand Company plant at Silica, O., where an installation is being put in including motors and switchboards amounting to $9,000.

Boston Contractors' Meeting.

The Electrical Contractors' Association of Boston, Mass., is to hold a series of "get-together meetings" during the present season. The first was held at the Edison Building recently, the speaker being Alfred L. Cutting, manager of an efficiency school, who spoke on the value of individual efficiency in creating an efficient organization. Meetings to come will be addressed by experts in various lines of electrical work.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Device for Bending Conduit.

In recent numbers of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN I have noticed descriptions of methods for bending conduit. The tool that I use in this work is one of the best that I have seen. It is illustrated in Fig. 1, and consists of the parts there shown. There is a 2 by 4-inch block rounded at one end and having two holes bored through it for fastening it to the bench on which the vise is screwed. Another piece 18 inches long and one inch square in cross-section, serves as a guide and on the end of this and of another shorter piece, there are marks that can be used as a gauge for measuring the conduit for the right length. The pipe is laid in the position shown and

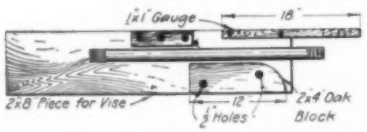


Fig. 1.—Bending Device with Conduit in Position to be Bent.

a larger piece of pipe slipped over the end that is to be bent. By applying pressure gradually to this larger piece of pipe, a symmetrical uniform bend can easily be made. W. N. Moss.

A New Device for Fishing Side Walls.

Having had considerable experience in wiring finished houses, I wish to describe my way of fishing wires to outlets in walls and partitions, which seems to be somewhat different from the usual way.

The fishing device I use is made of a piece of well waxed shoemaker's string and a piece or wire solder some four inches long. I double the solder by bending it in the middle, and then tie it on one end of the waxed string. Four loop knots are tied in the string just above the solder. The string is so strong that there is little danger of it being broken; the weight of the attached solder carries it down in the wall readily; and the loop knots afford a ready means of catching the string at the outlet with a short wire.

A. B. Whiteman.

Wiring to Wall-Bracket Outlet in House With Floor Running Under Partition.

Sometimes a wireman is called upon to install a bracket on a partition wall in a finished house having floors that run under the partition. I find it a good plan in such a case to take up a floor board in line with the wall outlet in such a way as to leave it convenient to make an opening which will make the space between the partition walls accessible.

When the board is to be taken up a five-eighths-inch hole is bored in it as close to the baseboard at the partition as it is possible to bore it, and the board sawed in two here with a keyhole saw, pains being taken to saw right along flush with the outer surface of the baseboard. Then, after a chisel and hammer have been used to pry the board loose along the length of it, it is pulled up with the hands, after which the end under the partition is chiseled off sufficiently to admit the wires back of the baseboard.

After the wiring has been done and the floor replaced, the room will show no signs of the workman's operations.

George L. Keeney.

Dipping Lamps While in Service.

During a recent convention in our city, we were called upon to color a portion of the incandescent lamps used in the illumination of certain streets. It was desired that every other lamp be colored. These lamps were suspended in such a way that taking them down and replacing them after they had been dipped would have meant considerable expense. Moreover, the job would have required more time than was at our disposal. What we did was to take a deep pail filled with the coloring liquid and fastened on a long fishing pole, and apply the coloring by this means without taking the lamps down. Thus we got the job done on time and the item of expense was inconsiderable.

Harold Peterson.

Floor Push.

Lacking a floor push for a table bell, I made one, using a two-cent window-bolt on which I slipped a flat washer. I ripped a few stitches in the carpet, bored a hole through the floor the size of the bolt, and ran a copper wire through this, fastening it to the floor with staples. On beam in cellar I screwed an inch and a half wide strip of spring brass, inserted the bolt with its washer, so that by pushing on the bolt electrical connection would be made. The wood being rather soft I packed connections with tin-foil. I have used this device some years, finding it satisfactory and cheap. The push is stiff enough to use under any rug; makes only a tiny hole if put through a carpet, is easily removed, and is unbreakable. J. F. Wheeler.

A Handy Tool for Soldering Small Work.

Fig. 2 illustrates a tool that I have found very serviceable in soldering connections on bell, telephone, and other small wires.

The rod of the small soldering iron has attached to it a cup-shaped receptacle about 1.25 inches in diameter, and 1 inch deep, this receptacle being fastened in place in any convenient way. The cup is filled with shredded asbestos saturated with alcohol and has a cover consisting of a screen of fine copper wire to hold the asbestos in place. The wooden handle on the soldering iron should flare considerably at the extreme end and should be cut off exactly at right angles to the length of the tool, so that the iron can

Fig. 2.—Soldering Iron Ready for Use.

be stood on end and left with the torch burning while the tool is not in use. The alcohol flame will keep the iron at a temperature sufficiently high for soldering light work. The tool is a great time saver. C. C. Sisson.

Fastening Large Lamps in Place.

The steel plant here has a number of large signs facing the railroad. These are illuminated at night by 250 and 400-watt tungsten lamps in flat reflectors. A great deal of trouble has been experienced from lamps falling out, due to vibration from wind and nearby machinery. A quarter-inch hole was drilled in the neck of the shade and tapped to take a five-sixteenth-inch setscrew ground to a point at one end. This setscrew was so placed as to bear against the brass ferrule just above the screw base of the lamp, but not in electrical connection with the same. A nut on each side of the shade kept the setscrew from turning. The saving in renewals effected by this simple arrangement has been considerable.

Frank M. J. Murphy.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 175.—Two-Rate Meters.—Has any American central-station company employed two-rate meters for residences and other small customers connected to its miscellaneous lighting circuits? What method is used to change from the low rate to the high rate during the time of peak load and back again? What effect has this had on the peak? Is the time of high rate adjusted during the different seasons to correspond with changes in the station peak? Does the two-rate meter eliminate the need for primary and secondary rates based on maximum demand? What is the relative cost of a 10-ampere, two-rate induction meter compared with a similar standard meter?—V. P. B., Milwaukee, Wis.

No. 181.—Repulsion Motor.—What is meant by a repulsion motor? How does it differ from induction motors? What advantages has it, if any?—T. A. J., Streator, Ill.

No. 182.—Searchlights.—Is a yellow-colored searchlight beam more penetrating on a foggy night than a white beam? What is the greatest distance that a searchlight has been seen on a clear night?—W. M. L., Baltimore, Md.

No. 183.—Slotting Commutators.—Has the practice of slotting commutators proven to be as valuable as was predicted several years ago? Is it increasing or decreasing in vogue? What is the best tool to use for this purpose?—F. S., Houston, Texas.

No. 184.—Wiring in Concrete Buildings.—Does it cost more to install a conduit wiring system in a reinforced-concrete building than in a building with steel and tile construction? If so, what is the percentage increase in cost?—E. W. M., Cincinnati, O.

Answers.

No. 165.—Synchronous Motor for Line-Voltage Regulation.—A short time ago I heard of the use of synchronous motors on a transmission line to keep the voltage constant at the receiving end. Is this method dependable and is it much used?—N. P. T., Fort Wayne, Ind.

The writer knows of two cases in which synchronous motors are very successfully used for voltage regulation. The system in question carries a very heavy induction-motor load with its usual low power-factor. At a point near its load center a 4,400-kilowatt synchronous motor has been installed. By varying the field strength, the voltage may be changed about six per cent in either direction. By the use of this motor the voltage is now kept within about two volts whereas formerly the variation was about twelve volts at 115 volts normal. Another synchronous regulator is used on the end of a 60,000-volt line about 30 miles long which has a load of about 7,500 kilowatts. This load consists largely of induction motors. The improvement in voltage in this case has been almost as marked as in the former. A very marked advantage of this sort of voltage regulation over other sorts is that the power-factor of the line can be held very nearly unity, thus increasing the capacity of the lines. In the latter case, at least, the capacity of the line would have had to have been increased had not this synchronous regulator been installed.—J. H. M., San Francisco, Cal.

No. 170.—Changing Fan Motor to Lower Frequency.—Is there any way in which an Emerson fan motor now arranged for 104 volts and 16,000 alternations can be made to run on 104 volts and 7,200 alternations?—J. W. K., Niles, O.

The standard Emerson fan motor for alternating current is of the squirrel-cage induction type and as in all other such motors the speed of the Emerson motor is governed by the number of field poles and the load, the no-load speed being equal to the frequency in alternations divided by the number of poles. This speed is decreased by increases in the load until the breakdown point is reached, or in other words, the point at which the maximum load the motor can carry has been placed on the machine. As the most desirable speed to operate a fan motor is about 1,800 revolutions per minute, no load, the motors designed for use on current of 7,200 alternations are four-pole, while those used on 16,000 alternations are eight-pole. The question of voltage does not enter into the matter of adapting a 16,000-alternation motor for use on 7,200 alternations, except in determining the resistance of the winding and the power to be delivered by the machine. To connect two of the poles of the 16,000-alternation motor in series would not have the desired effect as it would double up the resistance in the field coils and have the effect of operating the motor at about one-half the rated voltage. If it is necessary that J. W. K. change from the higher frequency to the lower, the most economical plan for him would be to sell his present machine and buy one for operating on the lower frequency. If he can find no buyers, the best thing would be to take the matter up with the manufacturer and either exchange his motor or else have it rewound by the manufacturer with a winding designed for 7,200 alternations. The rewound motor will be satisfactory as the only difference between the motors for 16,000 alternations and those for 7,200 is in the winding and the amount of end copper on the armature. The difference in the amount of end copper on the armature is not sufficient to interfere with the proper operation of a motor of the size used on fans.—E. C. B., Kansas City, Mo.

We assume that the motor in question is of the induction type. In order to have the motor operate satisfactorily it will be necessary to rewind it. Although it would be advisable to refer the matter to the manufacturers, the following may possibly be of assistance: As no data are included regarding the design of the motor the discussion will be general. Rewind the motor for half the present number of poles using the same distribution and connections of windings as at present except that ten per cent more wires per slot should be used in the main and starting windings than at present. The size of wires should remain the same as at present, provided there is room in the winding spaces for them. With this winding the speed of the motor should be approximately nine per cent lower, when operated on a 104-volt 60-cycle circuit, than the original speed.—C. L. S., Chicago, Ill.

No. 174.—Renewal of Plug Fuses.—What is the practice of large central-station companies that supply Edison plug fuses for the cutout cabinets of residence customers; do they throw away the blown fuses or attempt to refill them? If carefully refilled so as to be substantially like new, will inspectors pass them? W. K., Wichita, Kans.

As trouble man for a power company I install a great many fuses of all kinds. All old fuses are thrown away. I believe there is a ruling by the Underwriters against refilling fuses. The inspector in our district will not approve any refilled fuses, although I understand that some inspectors do so in certain cases. Our company uses a great many plug fuses, but they are used only in metal cabinets or asbestos-lined boxes. The customers are charged five cents for each; they are too cheap to pay any one to take the time to refill them. In my rounds, however, I have found a great many New Code fuses with nails, solder wire and copper wire wedged in beside them. There is a penalty against this practice but the people resort to it when thinking only of getting light. I have seen canopies blown to pieces and the ceilings blackened when a short-circuit or ground was burned off on inserting too heavy a fuse. By buying fuses in wholesale lots it will be found that they can be secured cheaply. The fuses on lighting circuits are frequently blown by grounds or short-

circuits in flatirons, vacuum cleaners and other appliances. If there is a ground on one of these devices it must be kept away from radiators, gas stoves or other metal parts likely to be grounded. The trouble man must look into this and advise the customer accordingly.—C. S. K., Grand Rapids, Mich.

No. 176.—Wireless Telephony.—What is the greatest distance over which wireless telephone communication has been attained? Is this affected by the same conditions that affect wireless telegraphy? —J. S. C., Missoula, Mont.

The greatest distance over which wireless telephony has reached is probably from Brant Rock, Mass., to Cuba, by Professor Fessenden, although this was merely experimental. Demonstrations have also been given by others over distances of 100 miles upwards, notably by Vanni, also Moretti, from Rome to Tripoli, and by Poulson, but these records must all be considered as experiments rather than commercial triumphs. The conditions are substantially the same as for wireless telegraphy except for the limitations of the apparatus, such as the power which can be handled by the transmitter. Although telephony can be carried out over a few hundred miles and although more power is required to cover a given distance than for telegraphy by the present radio apparatus, the limitations of the apparatus developed to date prevent the commercial success which many are still led to believe exists. Radiotelephony will doubtless come into its own as soon as the detailed problems are solved, as the basic principles are now well understood and demonstrated.—P. E. E., Minneapolis, Minn.

No. 177.—Reissue Patents.—What is meant by a reissue patent? What is its life? I have always thought that patents cannot be renewed in this country and only recently ran across a reissue patent.—N. A. A., Troy, N. Y.

N. A. A. has confused "Reissue" with "Renewal." Patents cannot be renewed in this country after they have expired, but it is provided in the statutes (Rev. Stat. Secs. 4895, 4916), also in rules 85, 92, Rules of Practice, that an inventor who has been granted a defective patent may under certain conditions have the same patent reissued. This reissue is intended primarily to preserve for the patentee any rights which he may have lost by reason of inadvertence, accident, or mistake in the presentation of the original case, provided the errors were made without fraudulent or deceptive intent. It is occasionally used to make an invalid patent valid, but cannot be employed to introduce new matter or extend the time beyond the unexpired term of the original patent.—P. E. E., Minneapolis, Minn.

The law of patents *re* reissues is as follows (Sec. 4916, Title LX, Rev. Stat., 1878, p. 950): "Whenever any patent is inoperative or invalid, by reason of a defective or insufficient specification, or by reason of the patentee claiming as his own invention or discovery more than he had right to claim as new, if the error has arisen by inadvertence, accident, or mistake, and without any fraudulent or deceptive intention, the Commissioner shall, on the surrender of such patent and the payment of the duty required by law, cause a new patent for the same invention, and in accordance with the corrected specification, to be issued to the patentee, or, in case of his death, or of the assignment of the whole or any individual part of the original patent, then to his executors, administrators, or assigns, for the unexpired part of the term of the original patent. Such surrender shall take effect upon the issue of the amended patent. The Commissioner may, in his discretion, cause several patents to be issued for distinct and separate parts of the thing patented, upon demand of the applicant, and upon payment of the required fee for a reissue for each of such reissued letters patent. The specifications and claim in every such case shall be subject to revision and restriction in the same manner as original applications are. Every patent so reissued, together with the corrected specifications, shall have the same effect and operation in law, on the trial of all actions for causes thereafter arising, as if the same had been originally filed in such corrected form; but no new matter shall be introduced into the specifications, nor in case of a machine patent shall the model or drawings be amended, except each by the other; but when there is neither model or drawing, amendments may be made upon proof satisfactory to the Commissioner that such new matter or amendment was a part of the original invention, and was omitted from the specifications by inadvertence, accident, or mistake, as aforesaid."

Section 4895 also says *re* reissues: "——— and in all applications for a reissue of any patent, the application must be made and the corrected specification signed by the inventor or discoverer, if he is living, unless the patent was issued and the assignment made before the eighth day of July, 1870."—W. M. P., Seattle, Wash.

United States patents run for seventeen years from date of issue and cannot be renewed. However, the Patent Office permits an inventor to correct an imperfect or inoperative patent by surrendering the original patent and applying for a "reissue" to correct the defects. Thus, if the inventor has "saved" money by patronizing one of the class of attorneys who employ cheap helpers, and the law student who worded the patent did not grasp the point of the inventor's conception, the patentee still has a chance to have the patent drawn more adequately. So also, if any serious slip was made by the Patent Office, the patent may be reissued. In the latter case, the fees may be waived, but usually the reissuing costs more than the proper preparation of an original patent, and application for a reissue must be made before the invention has been patented or in public use for more than two years. The applicant must show that the defects in the original patent were not intentional, for otherwise the reissuing would serve as a ready means for extending the term of his monopoly. But when this can be shown, a shrewd patent attorney can often word the reissue patent to have a scope far beyond the inventor's original conception of what he had invented. As might be expected, reissue applications are often filed in an endeavor to enlarge the scope of patents which are perfectly operative and valid, in which case the applications usually are rejected. However, the original patent is then returned to the patentee (or his assignee) intact and in full effect just as if no application for a reissue had been filed.—A. Scheible, Chicago, Ill.

No. 178.—Automobile Headlights.—Several cities have agitated and I believe Chicago has passed an ordinance forbidding the use of glaring automobile headlights. Is any simple dimming device on the market for cutting down the brightness of electric headlights in the city, which is arranged to permit full brightness when a dark stretch of country road is reached?—H. J. W., Morgan Park, Ill.

To the writer's knowledge, there is no simple auto-headlight dimming device on the market. A double-throw double-pole switch or a snap switch which would alternately put the two headlights in series or in parallel would be simple, inexpensive, and efficient.—R. L. L., Minneapolis, Minn.

This party can be easily taken care of by local electricians who would get the proper amount of dimming by means of a resistance unit (whose capacity would vary as the number and candlepower of the lamps) of a waterproof type inserted into the circuit feeding the headlights. This to be left in while lights are to remain dim. An ordinary single-pole snap switch can be used to short-circuit this resistance when full light is required. Another method that is in common use on street-car headlights is the use of a fine wire screen placed in front of the lens for dimming.—W. M. P., Seattle, Wash.

No. 179.—Gold From Sea Water.—I understand that attempts have been made to extract gold electrolytically from sea water. What success has been attained? Is it a commercial process?—S. M. P., Toronto, Ont.

The notion that gold can be obtained on a commercial scale began, I believe, when a certain stock-selling company turned an

innocent remark by Sir William Ramsay into a gold mine, i. e., for the stock sellers. The amount of gold present in sea water is so slight that schemes for its recovery appear to deserve no more attention than would similar plans to recover the trace of radium noted in some of our inland streams.—P. E. E., Minneapolis, Minn.

Processes for the extraction of gold from sea water, electrolytically and otherwise, have been a favorite game of the chemical and metallurgical bunco-steerer. Probably the most famous of recent years was that of Rev. Dr. Jernegan, who formed the American Gold Extraction Company. The method was the precipitation of gold from sea water in "accumulators," which had a platinum anode and a mercury cathode, the sea water passing over the electrodes in a continuous stream. (For a full description of these accumulators, see *Engineering and Mining Journal*, p. 581, Nov. 12, 1898). It was clearly shown afterward that in the preliminary trials of this apparatus, a diver was employed to put "salted" amalgam in the accumulator (cf. *Eng. and Min. Journ.*, pp. 122, 124, July 30; pp. 151, 154, Aug. 6; p. 242, Aug. 27, 1898; p. 593, May 20, 1899). A plant was erected in Maine. The company paid one or two dividends from proceeds of the stock sales, and then Jernegan decamped to Paris. The gold "extracted" by the company was all shown to have been sent from Philadelphia, labelled "platinum wire." Another electrolytic method was that of R. Sauerwald, promoted by C. S. Walker, 130 Queen Victoria Street, London. The idea was to precipitate the gold from the water flowing through the condensers of steamships. Beyond the attempt to raise £3,-100 for a commercial test I can find nothing further about it. (*Eng. and Min. Journ.*, p. 674, June 10, 1899). Another English company was formed to put up a plant on the coast of Cornwall in 1901, as "the Gulf stream was richer in gold than other water" (*Eng. and Min. Journ.*, p. 737, Nov. 30, 1901). This likewise died out. A still later process was that of Snell, which was promoted by F. L. Rawson as the Industrial & Engineering Trust. This was organized in 1904 with 3,000 shares at £1 each, and a plant erected at St. Helen's, Isle of Wight. The attainments of its promoters may be judged from the fact that they claimed 0.5 to 1.0 grain of gold per ton, say 2 to 4 cents, and then claimed an extraction of 16 to 20 cents per ton. Nevertheless shares sold as high as £100 before the bubble burst.

Some patents covering the process are W. F. Heathman, United States 576,118 of 1897; H. C. and V. Ciantar, British 689 of 1904, who passed sea water through agitated mercury; W. L. Peat, British 3,470 of 1903, same idea; John F. Duke, British 12,610 of 1899; United States 734,-683, who dug reservoirs in chalk cliffs, the chalk throwing down the gold as carbonate (?); and W. H. Martin, who obtained a patent in 1902 (of unknown number) is said to have had an electrolytic process.

Much of the misconception of the possibilities of this process seems to have arisen from a misquotation. Sonstadt (1872) is declared to have said there was "one grain present." He did say "there was less than one grain." Personally I believe J. R. Don, of Otago, did about the best work on the subject; he found about one-sixteenth grain. Apparently the earliest believer in the idea was the monk Odomar, about the year 1350. Apparently the latest to believe in the process a commercial possibility is Oskar Nagel, with his ingenious work on "selective retention by filtering media," described before the American Chemical Society in 1912, but not appearing in its published transactions. This, however, is a chemical, not an electrolytic process. However, S. M. P. may be sure that there has been no successful process, nor is there likely to be. The effluent solutions from cyanide plants contain many times as much gold as does sea water—they are not even yet a commercial proposition to treat.

If your correspondent wishes to examine the quantitative data on the subject of gold in sea water, the following bibliography in F. W. Clarke's "Data of Geochemistry" covers the entire field: "The fact that sea water contains gold was first established by E. Sonstadt in 1872 (*Chem. News*, 25, 196, 231, 241, 1872; 74, 316, 1896; *Am. Chemist*, 3, 206, 1872). Its presence has since repeatedly been verified. In 1892 C. A. Munster (*Journ. Soc. Chem. Ind.*, 11, 351, 1892, From Norck Tekn. Tidsskr.) examined water from the Kristiania Fjord, Norway, and found in it 5 to 6 milligrams of gold, with 19 to 20 of silver, per ton. In each analysis he used 100 liters of water. Liversidge (Proc. Roy. Soc. New So. Wales, 29, 335, 359, 1895) found the gold in Australian waters to range from 0.5 to 1.0 grain per ton. At either rate, gold is present in the ocean in thousands of millions of tons. Liversidge (*Jour. Chem. Soc.*, 71, 298, 1897) also detected gold in kelp, rock salt, and a number of saline minerals, such as sylvine, kainite, carnallite and Chilean niter. In one sample of kelp be found 22 grains of gold per ton, and in a bittern, 5.08 grains. J. R. Don (Trans. Am. Inst. Min. Eng., 27, 615, 1897) examined both ocean water and oceanic sediments. In the former he detected 0.071 grain of gold per metric ton, but the sediments were barren. In waters collected near the Bay of San Francisco, Wagoner (Trans. Am. Inst. Min. Eng., 31, 806, 1901) found, also per metric ton, 11.1 milligrams of gold and 169.5 of silver. In deep sea dredgings Wagoner detected even larger quantities of both precious metals. (Trans. Am. Inst. Min. Eng., 38, 704, 1907). P. DeWilde (Arch. Sci. Phys. Nat., IV, 19, 559, 1905) and A. Wiesler (*Zeitschr. Angew. Chem.*, p. 1795, 1906) have published good summaries relative to the detection of gold in sea water, and also discussed the possibility of its economic recovery."—D. M. L., Elizabeth, N. J.

No. 180.—High-Capacity Storage Batteries.—In storage batteries for automobile use, what is the highest capacity in kilowatt-hours per pound of complete cell that has been obtained?—A. C., St. Paul, Minn.

Usually, in speaking of capacity in electric automobile batteries, the ampere-hour capacity is meant. This is a great mistake, for it is very misleading. It is easily seen that 40 cells connected in series have no more ampere-hour capacity than has one cell, although the 40 cells have 40 times the power of the one cell. Therefore watt-hour, and the more common unit, the kilowatt-hour, should be used to designate all capacities and is so used in this note. The lead battery which comes nearest to the nickel-iron cell in its capacity per pound is one with very thin plates and is therefore compared in the following table to the nickel-iron cell.

Type.	Watt-Hours.	Wt.	K. W. H. per Lb.
Lead	756	64.5	.0117
Lead	816	66.25	.01232
Nickel-Iron	540	40.8	.0132
Nickel-Iron	360	27.5	.0131

The above are capacities at normal rates of discharge. From this table it appears that the nickel-iron battery has 7.1 per cent per pound more capacity than has the lead cell. This is true only so long as the batteries are discharged at their normal rates of discharge. Batteries in truck service seldom are so discharged, the rates usually exceed the normal and this is where the internal resistance of the battery plays a very important part. On account of the higher internal resistance of the nickel-iron cell, it suffers a high drop in voltage under heavy discharge rates which greatly cuts down its *effective capacity* per pound of cell so that it is lower than the lead cell. This is best illustrated by the following table in which all conditions were equal for a fair test.

Battery	Per cent Grade.....	Miles per hour.....	Time on grade in hours.....	Current draw.....	Ampere-hours.....
Nickel-Iron	6	4.7	1.276	122	156
Lead	6	6	1.0	100	100

The above is representative of a normal condition. In any battery there is a drop in voltage when the current draw is increased. The higher the battery internal resistance the greater this drop and the more the current must be further increased to make up for the drop in voltage.—R. L. L., Minneapolis, Minn.

THE PROSPECTS FOR ELECTRICAL ENGINEERS.[1]

By E. W. Marchant.

It seems to me that the time has come when it might be advantageous to look round at the vocation of an electrical engineer, to see what he has accomplished and to make an attempt to determine the place he should fill in the industrial world, and of the steps which may appear possible to improve his status, and the reward he should receive for the long and arduous training through which he has to pass before he can be regarded as a fully qualified member of his profession. My chief reason for discussing this subject is that the electrical engineer to-day is a very specialized person. Electrical engineering has developed so rapidly and in so many directions that it is now impossible for one man to keep in touch with what is happening in all the branches of activity in which electrical engineers are employed. Each man becomes obsessed, and very rightly so, with the work for which he is responsible; he busies himself in becoming acquainted with the technical development of his subject, and there is, I think, some danger that the "human" aspect of his profession may become forgotten and may be neglected.

The electrical engineer, like every other member of the civilized community, has to take a place in the social structure; his position must depend (and here I do not mean his position in any narrow sense) on his recognition of the position his labors take in the work of the world. On the recognition of this fact by the world at large depends his future, not only from the point of view of influence, but also financially, and it is from this standpoint that I wish this evening to take a brief survey of his position.

The construction and supervision of stations for the supply of electric power must always provide occupation for a considerable proportion of electrical engineers. The running of a small station requires a comparatively small amount of general knowledge of electrical engineering principles. The ideal central-station engineer is one who must possess a great variety of qualities; not only must he be a good engineer, but also a good man of business.

The central-station engineer is destined, in the future, to take a still more important place in the life of the community than he occupies at present. The remuneration offered, however, to those taking up this work is quite inadequate to its responsibility. Successful central-station engineers, in all but the largest cities, have, in many cases, forsaken their positions to take up consulting work, and are retained by their former employers as consulting engineers. It would surely be better worth the while of most central-station authorities to have at the head of affairs men of experience who would be able to do all the necessary work for the central station, without calling in outside advisers. If this is to happen, it must be made worth the while of the central-station engineer. It is significant that the salary offered to those who wish to enter some of the power companies has increased to a most marked extent during the last year or two, due to the fact that the supply of men has rapidly fallen off. I heard the other day of a case in the West of England where an engineer who, years ago, had dozens of men on his books who were anxious to get into central-station work, now had none. The list of vacant positions in the electrical journal advertisements is more than twice as long as that of men wanting employment. This is a very healthy sign and a hopeful augury for those who have started in this profession. If the office of electrical engineer to a town or city is to become one of increasing honor and importance, it is essential that it should be filled with thoroughly trained men. I do not wish, here, to lay great stress on college education, though that, in the view of educators, is an essential element in the training of such people; but that they should be persons of good general knowledge and high intelligence, that they should be competent, when the time comes, to assume the greater responsibilities which will rest upon them. To attract such men it is essential that these positions should be made financially remunerative. One cannot expect a man of promise to be content to spend 10 years of his life preparing for a profession which in the end will yield no adequate return for his expenditure of time and money.

A panel doctor with 1,200 patients receives a fixed income of at least $1,800 a year, and this may be regarded as a minimum salary for a qualified medical practitioner to-day. The training through which an electrical engineer engaged in central-station work now has to pass, with three years at college and three or more years at works, is as exacting as that which a doctor receives. Surely such a man, whose work affects the life of the whole community, deserves as ample a recompense as the man who treats a limited fraction of its members.

The electrification of railways seems likely to be the direction in which the most important developments will take place during the next few years. The electrical engineer who intends to go in for railway work has, apparently, a great opportunity. It behooves the electrical engineer who looks on his work as his future vocation to equip himself with a thorough knowledge of railway conditions. Take two obvious examples: the arrangement of a schedule of trains for a suburban line is a problem of some mathematical complexity; the estimation of the power taken by an electric locomotive on a given line of road entails a large amount of detailed calculation and a thorough knowledge of mechanical principles. For this class of work the necessity for a good general engineering training is obvious, but, given this essential training, the field of the electrical engineer in railway work becomes a very wide one. As electric railways progress it seems certain that the position of mechanical engineer to a railway will be filled by an electrical engineer, and if the success that has attended the promotion of engineer to the position of general manager of a railway has the effect one may reasonably anticipate, the electrical engineer may regard as a legitimate aspiration that he should be called on to fill this great administrative position.

The greater number of men with whom we, in the universities and technical colleges, have to deal, find their way to the manufacturing firms, and a considerable proportion of the membership of the Institution is engaged in the design and manufacture of electrical machinery and apparatus. The equipment of the engineer intending to take a responsible position with a large firm has to be, from the technical standpoint, more complete and thorough than that required in any other branch of electrical engineering. It is easy enough for men who have had college training to enter works at the present time; most manufacturers seem only too anxious to obtain their services, and a living wage is paid from the start, but the number of openings that are better paid is much less numerous. There is a great gulf fixed between the men who are "just" on the staff and those in leading positions in a works, and in the long interval that might elapse before one of the former class becomes eligible for the higher positions, there is a period of great difficulty for most engineers in which the best men feel that they are wasting their time. In some cases, men have left the profession who would otherwise have proved themselves a valuable addition to it. The main point that I would urge is that this condition is a discouragement to many able men, who might otherwise have entered electrical engineering, and have done much to advance it. I was discussing this matter the other day with a man in a good position with one of the best electrical engineering firms in the country, and he gave me his opinion that in his firm a man of initiative and energy might hope by the time he had reached, say 35, to receive a salary of $1,500 a year; I think all will agree that this prospect is not such as to attract into electrical engineering the bright minds and keen intelligence which it is so essential for the wel-

1 Extracts from the inaugural address of Professor Marchant as chairman of the Manchester Section of the Institution of Electrical Engineers, delivered at Manchester, England, November 4.

fare of the industry should be attracted.

Even in the early days of an engineer's career in a works, his remuneration is less than it should be. I know of one firm that offers a college-trained man who has served his apprenticeship $7.50 a week to start with; a mechanic who has served his time can get $12.50. What is the result? The only men who go to this firm are those who want to get practical experience, and are on the lookout for a better post from the start. The best men leave almost at once, the men who are not worth much remain. The manufacturers have been in a very strong position in the past, because the supply of trained men on which they could draw has been large; now conditions are changing, and I would urge, as strongly as I can, that in order to attract the best type of persons into the profession of electrical engineering, the standard of remuneration for technical men must be advanced. Surely it is to people of this type that a manufacturer must look far more than to any other for the progress and advance of his business, and it is of the greatest importance to him to ensure that such people shall be forthcoming in the future. The prospects of the manufacturer today, I believe, are better than they have been at any time during the last decade. It is, therefore, a suitable time at which to urge this matter, and to lay stress on the necessity of ensuring that the prospects of those entering an electrical engineering works shall be at least as good as those in any other branch of engineering practice.

The application of electrical energy to chemical manufacture has made great strides during the last decade, and the price at which electrical energy can now be sold makes it evident that electrochemical processes will come even more extensively into use, not only for the manufacture of alkalies, carbides and the like, but also for smelting iron and steel. The questions involved in the application of electrical energy to purposes of this kind are essentially engineering problems. Electrical engineers should find a considerable field for their activities in this direction, and one of the advantages this branch of engineering possesses is that it is likely to be rapidly progressive as the cost of electrical energy decreases. It is to be hoped that this work will not be left in the hands of those more directly concerned with chemical problems, as progress is much more likely to be rapid if the mechanical design of the plant is sound. A thorough engineering training, combined with a good knowledge of chemistry, is provided in most of the larger technical schools and colleges. It remains for the users of these processes to employ the raw material that is being produced.

The consulting engineer has been consigned by some people to a speedy end, as far as electrical work is concerned, his place being taken by engineers employed by large firms. It will, however, be a long time before the consulting engineer finds himself without occupation. Consulting engineering as a vocation can, however, hardly come within the scope of this brief survey, since a consulting engineer is necessarily a man who has had experience in one of the branches of engineering to which reference has been made already. I have made some attempts to classify the membership of the Institution with a view to finding the proportion engaged in each branch of work. The classification is very incomplete, and has been applied only to the class of members. The thing that has surprised me has been the apparently large proportion of men engaged in the busines of the supply of electrical power who are members of this Institution. That, of course, is the greatest work at the present time, but it is one which will not, I believe, tend to increase very rapidly as an employment for engineers. The tendency today is towards large power stations and long transmission lines; anyone who has seen the large power stations in Canada and the States, especially those operated by water, cannot but have been impressed by the very small number of engineers which a station of, say, 50,000 kilowatts, requires.

The electrical engineer of the future must be a person who can take a broad view of his profession; whether he be engaged in central-station work, in manufacture, telegraphs, railways, or as a consultant, he must be able to see all sides of a question. He must be able to solve new problems along sound lines. If men of this kind are to be available as electrical engineers, it is essential that the best type of person must enter the profession. The position today is critical, and on the attitude of the industry to its engineers depends the future of the electrical engineer. The magnitude of the tasks that lie before him, the complexity of the problems he has to solve, the greatness of the results he can achieve are unequaled in any other calling. For the best results the best men should be got, and whether the best men enter electrical engineering depends entirely, or almost entirely, on whether it is made worth their while to do so.

As far as one outside the industrial world can judge, the prospects of the electrical engineering industry at the present time are exceedingly good; they are even better if one takes into account the openings that are available for those willing to go abroad; it behooves the electrical engineer, then, to make use of his opportunities and to see to it, as far as lies in his power, that there may be great difficulty in obtaining really competent and well trained electrical engineers at too low a rate of salary. It must be acknowledged that the income derived at the present day by most electrical engineers from their profession is generally not high enough, considering the importance of the work they have to perform.

The matter is one of supply and demand; the supply hitherto has been ample, the demand meager; now, demand is overtaking supply, and the necessary consequence to an increased demand is either a worse quality of product or a higher price.

It is to be hoped that the members of this Institution who have it in their power, will see to it that it is the latter alternative that is chosen by the electrical engineering industry.

Illumination of Street Cars.

A meeting of the Chicago Section, Illuminating Engineering Society, was held in the Monadnock Block, Chicago, on the evening of November 12, Chairman M. G. Lloyd presiding. The meeting opened with the first of a series of twenty-minute talks on "The Fundamentals of Light and Illumination," by William A. Durgin. With the aid of numerous interesting experiments Mr. Durgin demonstrated some of the fundamental laws of light in a clear and striking manner, touching particularly on reflection, refraction and color effects.

The main topic of the evening was introduced by the presentation of a paper by L. C. Porter and V. L. Staley, of Harrison, N. J., entitled "The Illumination of Street Railway Cars." This paper was read by Mr. Porter and was illustrated with numerous lantern slides. Until quite recently little has been done toward improving the lighting of street cars. A great majority of such cars are still lighted with clear, bare carbon lamps. These lamps not only give annoying glare, but on lines on which the voltage regulation is poor there is produced a marked fluctuation in the illumination, the latter becoming inadequate, especially during the rush hours.

About two years ago an investigation of methods for improving street-car illumination was undertaken jointly under the direction of G. H. Stickney, of the General Electric Company, and S. L. Holst, of the Bay State Street Railway Company. A large variety of types of cars were equipped with different lamps and several methods of installing them. The first of these was the replacing of the old carbon lamps with 23 or 36-watt tungsten lamps, this bringing about an increase in the illumination at normal voltage of 6 per cent and 66 per cent, respectively; at 80 per cent normal voltage there was a still greater increase of illumination from tungsten lamps over that furnished by the carbon lamps, due to better regulation of the former. The power saving from the replacement of the old with the tungsten lamps was 65 and 44 per cent, respectively. The lamps were installed both on the half-deck system with one row of lamps

on each side of the car and on the center-deck system with a single row along the center of the roof of the car. In the latter case it was found that either two circuits of 56-watt or one circuit of 94-watt tungsten lamps give ample illumination. In the arrangement with 56-watt lamps, six lamps were located in the body of the car, one on each platform, one in each end sign and one in the headlight. Where two sign lamps were needed at each end 28-watt half-voltage lamps were used, two of them in series being equal to one 56-watt full-voltage lamp. Where 94-watt lamps were used, four of them were placed in the car body, one on the rear platform and an auxiliary circuit of 23-watt lamps was installed for signs and for a headlight. This arrangement provides but one circuit in the car body, consequently failure of one lamp leaves the entire car in darkness temporarily; to facilitate locating burned-out lamps a selector switch was provided on the platform, by means of which the conductor could quickly bridge an extra lamp across each of the deck lamps in succession, finally leaving this in place of the burned-out lamp. When more than one circuit was provided in the body of the car, alternate lamps were wired on separate circuits.

Careful consideration of the requisite intensity of the illumination showed that from 2.5 to 3 foot-candles was desirable on a reading plane assumed to be at 45 degrees and three feet above the floor, corresponding to the position in which the average reader holds a paper. To provide this required illumination with the present types of railway tungsten lamps, about 10 watts per running foot or 1.25 watts per square foot of floor area is needed. Indirect and semi-indirect systems were also tried, but these required the use of very light headlining.

With all of the direct-lighting installations with tungsten lamps it was considered imperative to use reflectors, both to screen the lamps from the direct line of vision and to diffuse their light and also to direct the bulk of the light downward upon the reading plane. Such reflectors must be sufficiently deep to screen the lamp filament from all passengers, except such as are almost directly beneath the lamp. An intensive type of distribution for reflectors was recommended both for center-deck and half-deck lighting as giving the best results. For direct lighting either clear prismatic or opal glass reflectors were found to give excellent service. Opaque reflectors are not recommended on account of the dark and gloomy aspect they give to the ceiling unless they are arranged for indirect lighting. The latter is not recommended, however, both on account of its lower efficiency and of the increased difficulty in cleaning. All reflectors must be supported by special shade-holders arranged so as to guard against the reflector becoming loose and dropping from its support. Several such holders provided either with strong fingers or a coiled helix are available; these holders also contain the lamp socket and can be readily mounted in the car. The interior finish of the car should be of light color in order to give a cheerful appearance and also to increase the illumination efficiency somewhat. If indirect or semi-indirect lighting is installed, the headlining must be of a very light color and kept clean.

The authors of the paper pointed out very strikingly the decided economy resulting from the use of tungsten lamps in place of either the old carbon or metallized carbon lamps. Despite the higher cost of the tungsten lamps there is material economy together with greater improved lighting from using them in place of the old lamps. The life of such tungsten lamps in actual service is from 1,200 to 1,500 burning hours. On account of these lamps being less affected by voltage fluctuations they give a steadier light.

A summary of the tests conducted on typical cars is included in the paper. Photometer readings were taken on a horizontal plane three feet above the floor. Readings were taken along five rows of stations; one in the center and two on each side thereof, respectively 19 and 38 inches from the center line; these stations were usually over the forward edges of cross seats and about two feet apart where longitudinal seats were used. A summary of the conclusions of the authors states that the use of tungsten lamps in place of carbon lamps is highly advantageous, because they produce better illumination at an actual saving in operating expense. Where tungsten lamps are used it is highly desirable to install efficient reflecting devices to reduce glare and also to increase the efficiency of light utilization. In all cases a light interior finish is desirable.

The discussion was opened by Dr. Lloyd, who referred to the need for the elimination of glare which has been extremely annoying in all types of street, elevated and subway cars. He also pointed out a number of features that have retarded progress in this line.

J. R. Cravath said that, despite the variety of reflectors now available, he did not think all of the requirements for this service had been taken into account. The reflector to be chosen should be of very simple design to permit of ready cleaning at a minimum expense. He was glad to see that the glassware now available is of better quality and heavier than was the case but a few years ago. The holders now on the market are also much more serviceable than the ones available hitherto. He emphasized the need of having sufficient depth in the reflector to properly screen the lamp.

A. J. Sweet briefly described the tests of illumination of steam-railway coaches conducted last summer under the auspices of the Association of Railway Electrical Engineers. He read the report of the conclusions of the committee which had been in charge of the tests, which were given on page 876 of our issue of November 1. While the conditions in a steam-railway coach are slightly different than those in a street car, the conclusions arrived at should be similar. He agreed with the authors that for cars with cross seats the center-deck lighting is just as satisfactory as the half-deck system and has the advantage of requiring fewer units, and therefore lower installation and maintenance cost. In cars having longitudinal seats, however, he thought the half-deck system was decidedly preferable in that it would more completely eliminate the glare from glossy paper for passengers reading. Despite the claims of various reflector manufacturers the value of the different classes of reflectors has been quite definitely determined. In the order of efficiencies a mirrored-glass reflector is highest, though not particularly suitable for this purpose on account of its appearance. Next came in order the clear prismatic reflector, heavy-density opal and light-density opal. Even the poorest reflector in point of efficiency is much better than a bare lamp. He recommended for the center-deck lighting that a type of reflector distribution half way between what are usually known as the intensive and extensive types as probably the best. The prospects for improvement of street-car lighting he regarded as very favorable.

H. H. Adams, of the Chicago Railways Company, discussed the effect of interior finish of a car. The present pea-green headlining and cherry wood finish in use in Chicago street cars he did not regard as the best. It is both too dark to give a cheerful appearance and not sufficiently efficient as a reflecting surface. He thought that a light-buff finish was the most practical one under actual operating conditions. A car so finished showed an improvement of about 50 per cent in illumination over a similar car with the darker finish, both tests being made with bare lamps. He thought that the present types of sockets and shade-holders are too obtrusive; by projecting too much they detract from the architectural appearance of the car. A study of reflectors is now being made by his company.

Mr. Porter replied to a number of questions respecting the reliability of tungsten lamps and their adaptability to street-car service. He referred to some tests conducted by a railway company in which an old box car was equipped with railway-type tungsten lamps and a locomotive was run into the car at various speeds to find out the effect on the lamps. It was found that it was necessary to collide with the car with a speed of nearly 40 miles an

hour before the lamps and reflectors gave way, the box car itself incidentally suffering to the same extent. He emphasized the conclusion he had brought out in the paper that the center-deck system was probably the best one for street-car lighting. It gives fully as good distribution as the half-deck system, places the lamps higher above the range of vision and is decidedly more economical in first cost and maintenance cost on account of the much smaller number of units. He also emphasized the great superiority of the tungsten lamp over the old carbon lamp and was pleased to see the considerable number of tungsten lamps in use in Chicago cars.

Replying to a question by Mr. Scheible as to the life of tungsten lamps under actual service conditions, Mr. Staley said that on the Bay State railway system 23-watt lamps were installed in a variety of cars and on lines having different types of roadbed. Under these varied conditions it was found that the average actual life was about 1,500 hours. Therefore it was safe to assume a rated life of at least 1,200 hours.

Recent Developments in Street Cars and Equipment.

At the regular monthly meeting of the Pittsburgh Section of the American Institute of Electrical Engineers, a joint paper on "Recent Developments in Cars and Equipment by the Pittsburgh Railways Company," was presented by F. R. Phillips, superintendent of equipment, and J. W. Welsh, electrical engineer, of the Pittsburgh Railways Company.

With the aid of lantern slides, the authors discussed the development of the trolley car from the time of the old horse-car to the present. Until quite recently, very little attention had been paid to the design of cars from the scientific standpoint. It is now generally recognized, however, that the habits of the people must have a great deal to do with the design of the cars from a scientific standpoint. Among the prime requisites for a satisfactory car design are maximum safety and convenience to the traveling public as well as the car operators. This is accomplished by low, wider and fewer steps, and center entrance and exit doors. It has been found in practice that the low steps reduces the average time of loading a car, thus allowing better schedules. Having the platforms entirely shut in and the steps and grab-handles completely inclosed by the doors when the car is in motion, very largely eliminates accidents due to attempts to leave or board a car while it is in motion.

Another prime requisite is the reduction in energy consumption. This is accomplished largely by a reduction of car weights. After a careful study it was determined that while many improvements were possible, yet no very great savings could be effected in the weight of the car body. The elimination of the forward and rear bulkheads and the use of cross seats on one side of the car and lengthwise seats on the other side, did, however, produce a certain saving in weight, and permitted an exceptionally large seating capacity without interfering with the freedom of passenger movement.

In a further attempt to reduce the weight of the cars, the Railways Company developed the low-floor type of car. By the use of 22-inch wheels, in place of the old 33-inch wheels, and by the use of drop sills, it was possible to lower the floor from a height of 43 inches to a height of 31 inches above the rail, with a decrease in step height of 13 inches. The easy entrance and exit facilities at the center of the car permit of very rapid loading and unloading. The first cars of this type were for trailer operation, so designed as to permit of ready conversion to motor cars later, and it was a matter of common note that the low-floor trailer cars could be loaded and unloaded in much less time than the regular motor cars of the same seating capacity. In addition, the low center of gravity and the arrangement of the springs gives a very easy-riding car; inequalities in the track are felt much less than in the ordinary cars. These cars weigh 371 pounds per seated passenger.

In a further effort to increase carrying capacity, the company developed a double-decked car, having a seating capacity of 110 pasesngers, with ample clearances for the tallest passenger to stand or walk, and weighing 400 pounds per seated passenger. This car was at first used as a trailer, but later was equipped with motors. Its operation is so satisfactory that five additional cars of the same general design have been ordered.

The operation of the low-floor cars as motor cars required the development of special motors of very small "barrel" diameter, rated at 30 horsepower. The armatures are long and narrow, being 10 inches in diameter by 14 inches long, as compared with 14 inches diameter and 10 inches long for an ordinary motor of the same capacity. The weight is the same as in standard motors. The trucks of the motor cars are equipped with 24-inch wheels, on a five-foot wheel base.

A special controller was also devised and built, to provide three running positions: (1) with all four motors in series; (2) with the ordinary series-parallel connection; (3) with all motors in parallel. Eight contactors make all the changes. One small resistance is provided which is in circuit only on the first position with all motors in series, no resistance being used for changing over to the parallel or series-parallel positions. The load on the motors is deliberately unbalanced during acceleration by not changing over the connections simultaneously. This provides easy acceleration, thus adding to the comfort of the passengers, and at the same time very largely does away with rheostatic losses. The controller proper is mounted under the car seats, and is operated by remote control.

Tests on similar cars, equipped with the old standard, and the new baby motors and controllers, run over the same route on the same days, and under exactly similar conditions, showed a saving of power on the part of the low-floor cars of 10.7 per cent per ton-mile, and 10.5 per cent per car-mile, with a gear ratio of 18:66. With the maximum possible gear ratio, 15:69, the saving was 13.5 per cent per ton-mile, and 13.3 per cent per car-mile. At the present cost of power to the Railways company, 10 per cent would mean an annual saving of $150,000 for power, if all of its cars were of the improved type. The efficiency of the small-diameter motors is slightly less than those of the larger diameter, but this is far overbalanced by the many other advantages.

During the discussion, which was participated in by C. A. Anderson, W. E. Moore, Thomas Elliott, G. M. Eaton, M. B. Lambert, R. E. Hellmund, R. E. Ferris, R. E. Doane, P. M. Lincoln, E. M. O'Donnel, A. M. Dudley and the author, the following points were brought out.

It costs about five cents per pound per year to haul idle weight. If capitalized, this means that any company can afford to pay one dollar per pound to reduce the weight of the cars. Mr. Elliott expressed the opinion that by the use of different and better materials, and by careful design, the present car weights could be cut in half.

A high center of gravity has always been recommended for heavy high-speed steam locomotives and is advocated for electric locomotives. But the experience of the Pittsburgh Railways Company indicates that a low center of gravity, with the method of suspension used, is extremely satisfactory. Although the cars have not been in service long enough (nor at any time exclusively on one line) to form an accurate statement, it appears that flange wear and track maintenance will be less than with the older car types, and very little difficulty has been experienced with flat wheels.

Although the baby motor is no lighter per unit than the older 50-horsepow-

er motors with which it is compared, it must be remembered that most electrical machinery of smaller output is heavier per unit output, so that it was no small achievement to produce a 30-horsepower motor of such unusual proportions with the same weight per horsepower as the larger motors.

The use of heat-proof insulation has been abandoned on the later motors, not because it was unsatisfactory in any way, but experience has indicated that even under the severest conditions of carrying as high as 250 people per car, the temperatures have never exceeded that for which cotton insulation is satisfactory and the latter is cheaper.

The small-diameter wheel has a greater tendency to deliver a hammer blow at points, etc., but this is overcome by the much smaller car weight.

The present narrow doors have been found to provide much better facilities than wider doors and big platforms, where the tendency has been to crowd the platforms until entrance is almost impossible.

Society for Electrical Development Growing.

During the first half of November over 200 applications for membership in the Society for Electrical Development were received at headquarters, largely as a result of the vigorous campaign now being carried through by the sales organizations of various member companies.

The total membership is now nearly 900 companies, who have pledged close to $160,000 to the Society's funds. Many applications are in transit to headquarters from various parts of the country. With assurances now in hand, it is believed that the membership will total more than 1,000 by December 1, and that the Society's prescribed minimum fund of $200,000 will be completed by January 1.

Those companies who have been withholding their memberships on the theory that perhaps the Society might not be able to carry out its plans, may now join with perfect confidence. The Society will very shortly be actively at work and those who are members from the beginning will have the distinct advantage of benefiting by all that the Society does from the start. Numerous incidents already have occurred which demonstrate forcefully the prestige and influence of the Society for Electrical Development.

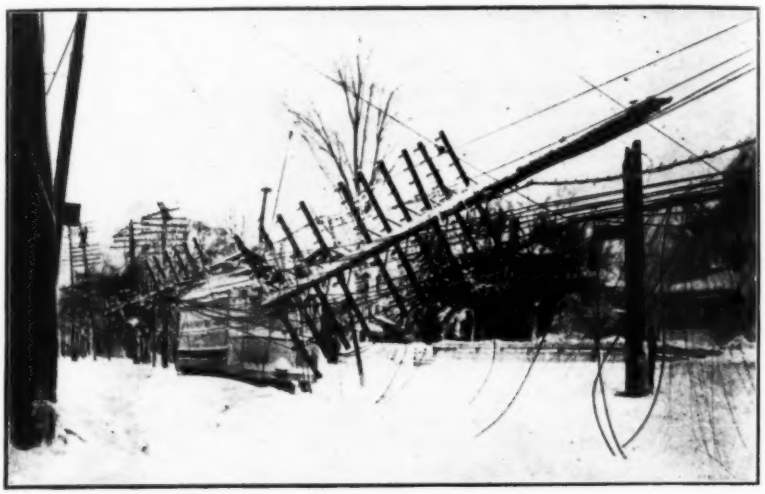
Telephone Fire.

On November 5 a brief conflagration in the telephone exchange at Montreal, Can., resulted in burning out both the local and long-distance switchboards.

Severe Storm Interrupts Service of Cleveland Utilities.

The worst storm in the history of Cleveland, O., visited that city on the evening of Sunday, November 9, and within four hours trolley service was abandoned upon the Cleveland Railroad Company's lines. Nearly all the overhead telephone lines in the city were put out of service, and the lines of the Cleveland Illuminating Company were largely crippled. The telegraph lines were out of operation until the following Tuesday. Only three of the 32 car lines in the city were able to run at all until Tuesday, and not one interurban car reached the city until late Tuesday night. John J. Stanley, president of the Cleveland Railway Company, estimated that $25,000 had been lost in fares alone. The damage to the railway company's property was not, however, nearly so great as to that of the other utility companies. The accompanying illustrations show some of the conditions resulting from this storm.

Telephone and electric light wires were broken during the blizzard and dropped upon the trolley wires. It was owing largely to the danger resulting from such contacts that power was cut off from the street railway lines, although many of the cars were stalled in snow drifts from three to six feet deep. In spite of the dangerous conditions only one person was killed by electric shock. Volunteer



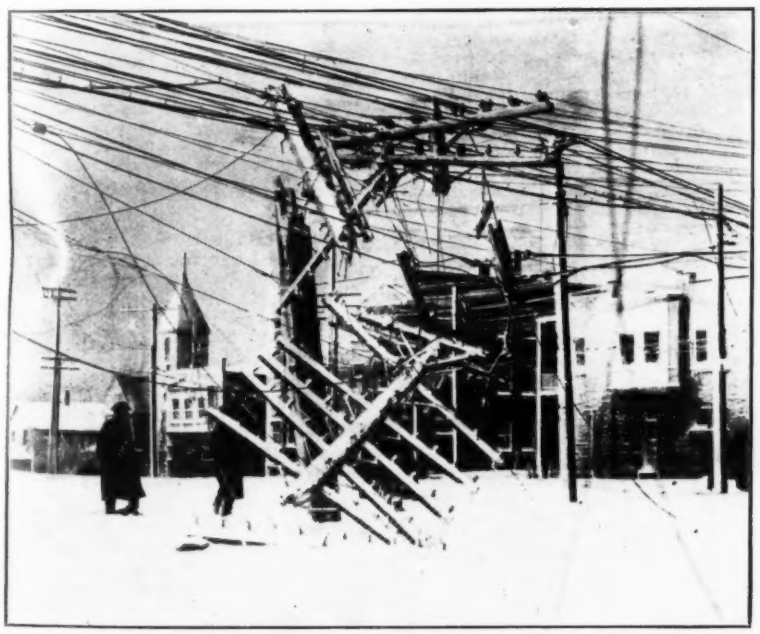
Blockade on Detroit Street, Cleveland, O.

Destruction on Pasadena Street.

linemen braved a sixty-mile wind and waded through deep snow to rid the streets of danger.

On Monday morning, the Cleveland Illuminating Company could serve only about 16 per cent of its patrons, although lighting service was kept up in the down-town districts and as far into the outlying residential territory as possible. By Friday night, 90 per cent of the consumers were receiving service. By that time 90 of the 107 big feeders were in operation.

Chaotic Conditions on Detroit Street, Cleveland, O.



Typical Scene of Tangled Wires, Cleveland, O.

The Cuyahoga Telephone Company had 10,000 lines put out of service, and the Cleveland Telephone Company had 15,000 lines disabled. Poles and wires were down in all parts of the city, and in one stretch of five miles not a single pole was left standing. Damage to the Cuyahoga Company was estimated in excess of $200,000, while the Cleveland Telephone Company estimates its loss as nearly $300,000. Several weeks will elapse before service is completely restored. All available linemen in other parts of the state were rushed to Cleveland and repair work commenced at once with 1,600 men at work. With but a few hours of intermission for sleep, these men have worked continuously to repair the damage.

Mayor Newton D. Baker congratulated the managers of the utility companies upon their activity in restoring service, and suggested the desirability of placing the wires underground to avoid a repetition of such a condition. By the terms of a city ordinance, each utility company is required annually to place underground three miles of wire, and this is being complied with by the companies, but it will take a number of years for the work to be completed at this rate, and Mayor Baker suggested a more rapid change to the use of underground conduits.

Chicago to Advertise for Proposals for Subway System.

William J. Shanks, secretary of the Chicago Harbor & Subway Commission, has issued a statement setting forth the status of the subway problem in Chicago.

The City Council of Chicago has authorized an advertisement for proposals to construct a comprehensive system of passenger subways, within the city limits, that will be operated independently of existing surface and elevated transportation lines, and that will be ultimately municipally owned, through the amortization of the construction debt out of earnings.

The ordinance authorizing these invitations to private capital to enter into a subway-construction partnership with the City of Chicago specifies certain subway routes that approximate 57 miles in extent, or approximately 135 miles of single track, for which the construction estimates approximate $96,000,000 for subway construction, and $34,000,000 for equipment, or an estimated total of $130,000,000.

The ordinance further specifies the form in which proposals for construction and equipment are to be made, the object being to secure competitive bids on the proportion of estimated gross receipts, from the operation of subways, that contracting parties may consider a necessary return for their investment.

The bids are also to specify: (1) What proportion of gross receipts shall be applied to a sinking fund to amortize the construction debt. (2) Rate of division between company and city of the remaining gross receipts, after providing for operating expenses, interest on investment, and sinking fund.

As the city's grant of operating privileges is limited, by statute, to 20 years, it follows that a liquidation of the construction debt will be based on the prospective subway earnings during the 20-year operating period.

The City Council has directed in the ordinance that on the receipt of proposals for the construction of a comprehensive system of subways, the same shall be canvassed, and if any proposal is deemed acceptable by the City Council, it shall be incorporated in a second ordinance, containing, in

substantial form, the detailed requirements of the first or preliminary ordinance; and that the second ordinance, containing the name of the person, firm or corporation whose proposal has been accepted, shall be submitted to a referendum vote of the citizens of Chicago at the municipal election on the first Tuesday in April, 1914.

At the latter election, it is proposed to give the citizens of Chicago an opportunity to express their preference for one of three alternative plans, for beginning the construction of passenger subways in Chicago, as follows:

(1) For a comprehensive system of through-route, high-speed passenger subways, extending approximately to the city limits on three sides, to be built by private capitalists, named in the ordinance, on such terms of partnership with the city as will secure the gradual liquidation of the construction debt out of earnings, leaving the actual subways municipally owned, and providing for the future transfer of operating equipment to the city, or a new lessee, at the end of a 20-year operating period.

(2) For a limited system of passenger subways, in the downtown district, to be built by the municipality itself, out of present and future accumulations in the "traction fund"; such city-owned subways to be leased to the present owners of Chicago's elevated railroads, for the latter's exclusive use, as a downtown clearing house for the elevated railroad system.

(3) For a limited system of passenger subways, in the downtown district, to be built by the municipality, out of the "traction fund," possibly supplemented by direct financial aid from the surface car companies, as suggested in the 1907 traction ordinances; the said downtown subways to be used exclusively for the routing of a proportion of surface-car traffic.

It is expressly provided that the second "comprehensive subway" ordinance, when submitted to the voters at the April election, shall become a law only (1) if it secures a majority of the votes cast thereon, (2) if it secures a greater number of votes than the votes cast in favor of the elevated-road subway ordinance, and (3) if it secures a greater number of votes than the votes cast in favor of the surface-car subway ordinance.

It will be noted that in the last two plans there is no necessity for competitive proposals, and that the operating terms to be arranged, if either plan is chosen by the voters, are confined to the elevated railways in one case, and to the surface railways in the other case.

ELECTRICAL EQUIPMENT OF AUTOMOBILES.

Monthly Meeting of the American Institute of Electrical Engineers.

The 288th meeting of the American Institute of Electrical Engineers was held at the Engineering Societies Building, New York City, on Friday evening, November 14. The meeting was called to order by President C. O. Mailloux, who turned over the chair to John M. Hipple, chairman of last year's Industrial Power Committee, which had arranged the program for the meeting. Papers were presented by Alfred E. Waller on "Dynamo Electric Lighting for Motor Cars;" by Alexander Churchward on "Advantages of Clutch-Type Generator and Separate Starting and Lighting Units for Motor Cars;" and by Frank Conrad on "Electrical Equipment of Gasoline Automobiles." Abstracts of these papers follow.

Electric Lighting for Motor Cars.

The design of motor-car lighting apparatus begins with the choice of a satisfactory lamp equipment. As a result of experimental work on headlights the author favors the 21-candlepower six-volt tungsten lamp with a parabolic reflector measuring 10 inches across the opening and 5.5 inches in depth. With a pair of four-candlepower side lamps and a two-candlepower rear lamp this fixes the quantity of energy which must be supplied and determines the dynamo capacity to be provided. A three-cell lead battery has been universally adopted for six-volt lamps and the dynamo must furnish 10 amperes at a voltage sufficient to charge such a battery. The dynamo must be geared so that it will carry the entire lighting load when the car is traveling at or above the average speed of 18 miles. The ideal lighting system is entirely automatic. The battery must be connected to the dynamo when the conditions are right for charging and disconnected when the speed is reduced to a point where the current would be reversed. The output of the dynamo should be limited to a predetermined and safe maximum regardless of speed. This leads to a discussion of methods devised to secure automatic control and to the speed rating of the dynamo itself. This is limited on one hand by the weight, size and cost of slow-speed dynamos and on the other by consideration of wear on bearings, commutator and driving means of the high-speed type. The author favors a shunt-wound dynamo in which the regulation is secured by a single step of resistance inserted in series with the dynamo field. This resistance has such a value that it will limit the dynamo output at the highest speeds obtainable to its predetermined maximum. It is normally short-circuited, but the short-circuit is removed when the maximum charging current has been reached. This is accomplished by means of a relay carrying the armature current. When the current is thus reduced the resistance is once more short-circuited and the relay contact vibrates so as to obtain a substantially constant current for a wide range of speed. To be capable of standing a 10-ampere charge for long periods, a battery should have at least 160 square inches of positive plate surface and 100 square inches of negative plate surface. The method of wiring is then considered. Ground returns have in many cases brought about ignition complications and the system of two wires is considered more advantageous. The insulation of wire for this purpose should be composed of material not affected by oil or gasoline and not softened by ordinary temperatures. Where rubber is used it should be protected.

Advantages of Clutch-Type Generator and Separate Starting and Lighting Units.

For supplying current for starting and lighting the modern motor car a constant-speed dynamo has many advantages over every other type of dynamo, viz.: (1) It charges a battery with a comparatively large current when the battery is low and empty, tapering off to a small charging rate. (2) Its comparative low speed, even at high car speed, means long life, small wear and maintenance, and reliability. (3) Its efficiency, even with great slipping of the clutch, is higher than that of a machine controlled by a "bucking series" coil or by regulation of the field current. In other words, the loss due to the friction and slipping of the clutch is less than the core loss of variable-speed machines running at high speeds. (4) Its ability to run the lights, even when the battery is disconnected—accidently or otherwise. (5) It can be geared to cut in at very low car speeds, as the speed of the dynamo armature never exceeds a safe, predetermined limit. Experience has shown in the past four years that it is far better to charge a battery at a moderate rate whenever the car attains a speed of 8 miles per hour than to charge at a very low rate at 10 miles per hour and gradually increase the charging rate as the car speed rises. A variable-speed, constant-current dynamo, giving enough current to take care of the lights, invariably overcharges the battery on long daylight runs of some hours' duration. The user may not have to renew the battery frequently, but the direct effect is to boil the solution out of the battery, and at some time when current is needed the battery fails because of a lack of electrolyte; or whatever electrolyte is left is so concentrated as to injure the plates. Experience in designing electric automobile motors during the past 15 years has demonstrated that to get the most out of a battery, regardless of the number of cells, the best design which can be employed is a series motor with a steep torque characteristic. A shunt-wound dynamo at constant-speed being the best for charging batteries, and having characteristics exactly opposite to those of a series motor, explains the reason for our adopting two-unit electrical systems for starting and lighting. For the same generator output and the same power delivered as a motor, a single unit cannot be built any lighter or cheaper than a two-unit system.

Electrical Equipment of Gasoline Automobiles.

The principal electrical devices used

on the gasoline automobile perform the functions of ignition, lighting and engine starting, their relative importance being in the order given. The service of the first two elements is of a continuous nature; that of the third is intermittent and momentary. The success of the gasoline motor is intimately connected with the success of the ignition system, a condition which has resulted in the development of this device to a high degree of perfection. The relative merits of various ignition devices are discussed and the use is advocated of an induction coil operating from a constant-potential circuit in connection with a device which will limit the current at low speeds and still permit sufficient current flow at the higher speeds. A variable-contact device is used to operate the coil at its most efficient point and this eliminates to a considerable extent the necessity of manual control of the firing point. This ignition system produces a spark no matter how slowly the engine is turned over, thus lending itself particularly to electric motor starting. A lighting generator should be capable of supplying current equivalent to the average lamp load, when the car is running at a speed of fifteen miles per hour. The method of regulation advocated is a demagnetizing series coil in the battery circuit, thus maintaining constant charging current. The lighting circuit is so connected that the current to the lamps will not pass through the series coil, thus tending to maintain a constant charging current independent of the lamp load. For starting purposes two schemes are possible, namely, the use of the lighting generator as a motor, or the use of a separate motor. The separate starting motor is advocated and its characteristics are discussed.

The dscussion was opened by H. Ward Leonard, who outlined the desirable features to be reached in an automatic lighting system for a motor car as follows: (1) the automatic regulator should so control the dynamo output that under all conditions the current shall not exceed its rated value; (2) the automatic control should be such that current will be forced through the battery, even if its resistance be abnormally high; (3) all movable elements should act independently of dashpots, frictional driving devices, grease, centrifugal devices, etc., and be independent of gravity and shocks; (4) the automatic regulator should not have any parts subject to wear and hence requiring adjustment; (5) it should be unaffected by changes of temperature met with in practice and the dynamo current should be independent of temperature; (6) racing of the engine should not materially increase the dynamo current; (7) as soon as the battery is fully charged and gassing, current should be automatically reduced; (8) an automatic indicator to show condition of battery should be in sight of the operator; (9) it should be possible to operate lamps with dynamo alone in case battery is inoperative. Mr. Leonard installed the first train-lighting system in the country 25 years ago between Chicago and Milwaukee. The great problem is to keep the battery in perfect condition and this hangs upon the design of the dynamo control.

Leonard Keeler took exception to Mr. Churchward's third claim that efficiency was higher with a clutch-type generator than with other machines. This is contradictory to both theory and experiment and he gave results of tests to verify his statement. The torque necessary at constant speed for constant current is a constant. The driver of the clutch-controlled armature varies in speed but supplies constant torque. Its power is the product of torque and speed. The additional power at high speeds is represented by the heat generated in the friction clutch and by additional power to drive the fan. The slipping also involves wear, requiring periodic readjustment. The tests showed that at 2,450 revolutions per minute 2.25 times as much power was required as for a shunt-wound machine with vibrating control. This ratio involves the loss in the driving motor. After correcting for this the ratio was 3.8. At 30 miles per hour the slipping-clutch dynamo takes 330 per cent more power to drive it than at 13 miles per hour. Under the same circumstances the shunt-wound dynamo with vibrating regulator requires only 25 per cent additional power.

A. W. Copley also disputed Mr. Churchward's statements. His second claim, that low speed means long life, applies only to the armature, but one member of the clutch must revolve at high speed and be driven by gearing or chain from the engine. The bearings of this part of the machine wear much more than those of the armature of an engine-speed bucking-series-coil type of generator. The most objectionable feature of the clutch type is the clutch itself slipping continuously. It cannot stay in proper adjustment and have either long life or reliability. The great heat generated at the slipping surface, which is transmitting energy, indicates that the efficiency cannot be high. Tests demonstrate this. He showed two sets of curves giving the results of such a test. The clutch-type machine had the higher efficiency only at very low car speeds with lights off. Under all other conditions the bucking-series-coil type had higher efficiency. The clutch-type of machine is also ill adapted for application to ignition. The combination of the two functions in one machine is, however, highly desirable. It is desirable to have the starting motor and the generator in separate units, and to avoid too many units the generator should be for lighting and ignition combined. He favored a single-wire system of wiring in preference to the double wiring, since one side of the battery is grounded anyhow on account of the ignition. Two wires introduce unnecessary complications. Single-wire systems are used extensively and have demonstrated their practicability.

A. D. T. Libby traced the development of lighting from an ignition battery, which is responsible for the use of six volts. He advocated a 12-volt system. He objected to the single-wire system of wiring because a single ground is then sufficient to make trouble. His company makes an ignition system which operates without the battery being grounded on the frame. He advocated separate units for starting and lighting, since different characteristics are required, and higher efficiency and simplicity could be secured by keeping them separate. The complications in the early systems caused some disfavor with electric motors. He took exception to some of the figures used by Mr. Churchward in his illustration. He agreed with Mr. Waller that the battery should be capable of taking the maximum output of the dynamo indefinitely.

Harold Goodwin, Jr., favored a single-wire system because most people do not test their circuit to see whether it is grounded. Consequently trouble is never discovered until there is a second ground and it is in the same condition as if it were a grounded single-wire system. The simplest wiring possible with well-insulated wire will give the least trouble.

C. E. Wilson submitted written discussion, which was read by the chairman. He called attention to a number of points brought up by Mr. Churchward in comparison of the two types of generators and the curves given in connection therewith, to which he took exception. His own tests do not give values in agreement with Mr. Churchward. He considered the decrease in charging current due to the heating up of the clutch type of generator and it is not characteristic of that type only. The regulation curve given was not typical. The curve given for performances of a starting motor was also not typical and differed widely from curves obtained by himself.

Benjamin F. Bailey also submitted written discussion describing his own work, which had led him to adopt a differentially compounded generator which involves no moving parts in the regulating apparatus, thus avoiding trouble and the necessity for adjustments. For connecting and disconnecting generator and battery a mer-

cury switch is used which answers the requirements of simplicity, reliability and no need of adjustment. This switch is mounted on the generator shaft inside the housing and the complete unit is self-contained. He compared this outfit with that described by Mr. Churchward and could not agree with the claims made by the latter. The saving in power from a tapering charge is trivial and the driving off of water he had not found of any consequence. He demonstrated that the efficiency was higher than with a slipping clutch. A constant-current system can operate with the battery disconnected as well as a constant-potential system, and he had found no difficulty for speeds from 15 to 30 miles per hour. He believed that a more efficient motor can be built for 12 volts, but his company uses a six-volt system in order to avoid the greater weight of the 12-volt battery. It is an open question whether it is better to have the generator and cranking motor as separate units. There is little difference in weight. The single-unit system is more convenient for the operator since there is usually no shifting of gears, this being accomplished automatically. With the two-unit system he thought it preferable to design the motor powerful enough so that only a single reduction gearing need be used. This requires a larger and more powerful motor, but the higher efficiency and saving in weight and cost of gearing offsets this. The total gear reduction would be about ten to one. He favored using the same system for lighting, starting and ignition as it is more reliable than the magneto. He illustrated the ignition device used by him, which gives a quick break independently of the speed of the engine, although the time of contact is greater for slow speeds. Many tests have been carried out upon different ignition systems to determine the output in joules per spark. This comparison is not entirely a fair one, since the rapidity with which energy is liberated is of importance.

Kingston Forbes spoke from the standpoint of the automobile engineer. The latter finds 42 different outfits advertised and marketed by the electrical companies for lighting and starting. He is confronted with the problem of whether to use 6-volt, 12-volt or 24-volt systems. The great necessity is to get the automobile as simple as possible. Multiplicity of control is often too great, and appliances in the automobile are being cut down as far as possible. 12-volt and 24-volt systems require more complicated wiring and switching, which is an objectionable proposition. The single-wire system affords greater simplicity and is hence more desirable. It does not seem advisable to have one unit for ignition, lighting and starting on account of the complication necessary. A separate starting motor in its simplest form, series-wound, with a generator to take care of both ignition and lighting, seems the logical solution. The location and method of operating the starting motor are problems for the automobile engineer, who desires this application to be made as simple as possible. Considerable trouble has been experienced with starting switches for handling high currents at low voltage.

The discussion was then closed by th authors of the papers. Mr. Churchward stated that in spite of the objections which had been made to the clutch type it was being used by 30 or 40 of the leading companies, who had not been able to get equally good results with other appliances. He had found the slipping clutch to require less adustment than a vibrating regulator. Since writing the paper he had finished experiments on a variable-speed machine of low speed suitable for direct connection to the engine, with an output of 10 amperes at 6.5 volts. This has all the advantages of a constant-speed machine: tapering charge; compounded to take proper care of lamps; lamps running direct from dynamo with battery disconnected at any car speed; will not be damaged at extremely high speeds on open circuit.

Mr. Waller spoke in opposition to the single-wire system, which was advocated by people who are not familiar with its application to the automobile. If the car frame is used as part of the circuit connection must be made by drilling and tapping it. This is on account of poor contacts from corrosion, etc. The two-wire system is just as simple as the single-wire, since both can be run in the same sheath. The cost in either case is insignificant.

Mr. Conrad presented curves to show that the tapering charge secured by Mr. Churchward was due to heating rather than an increase of battery voltage. The same effect is obtained in the bucking series generator but the effect is less on account of heating of the shunt coil.

First London Commercial Motor-Vehicle Exhibition.

The first exhibition of commercial motor vehicles was recently held in London. The proposal to have such an exhibition was made some time ago, but it was deemed advisable to postpone it until it might be justified by the wider use of commercial motor cars. Displays were made by more than 60 manufacturers.

Electric Buses for New York City.

The Electric Vehicle Association of America is lending its support to the People's Five Cent Bus Company in its fight for a franchise to operate 20 routes in New York City. Various electric-vehicle interests are rallying to the support of this concern, which had a hearing before the Board of Estimate on November 13. Among the speakers at this hearing were Frank W. Smith, president of the Electric Vehicle Association of America, and M. R. Hutchison, representing Thomas A. Edison.

The People's Five Cent Bus Company's plan includes a zone system, the fare within each zone to be five cents. Thus a man riding from the Battery to Harlem would have to pay ten cents, but the man wanting to go only as far as Forty-second Street would make the trip for a nickel. It is argued that most bus rides are for comparatively short trips, and that this zone division with a five-cent fare would give cheaper transportation for the majority of bus riders.

Opposition to the plan comes largely from the street railways and existing bus lines, among whose statements is that further increase of motor trucks throughout the city will endanger the lives of pedestrians. To offset this, Mr. Smith presented evidence as to the superior ease of operation of electric vehicles and their simplicity of control. He stated that within New York City were 500 enthusiastic owners of electric trucks, using 2,100 of these vehicles, and that these owners would be willing to testify before the Board of Estimate as to the greater safety in operation of electric vehicles. Or if the Board preferred, the Electric Vehicle Association would gather these statements and present them to the Board.

Thomas A. Edison, who had expected to appear in person, was kept at home by a severe cold and sent at his representative Miller R. Hutchison, chief engineer of the Edison Laboratories, with the following letter: "I believe that for traction in cities the electric motor will displace all other motors. Already it has displaced steam on street cars, elevated railways and subways. It drives all of the elevators and most of the machinery in the city. If buses are desirable for intercity traffic, the electric is the only practical one. It is noiseless, has half the destructive effect of a gasoline engine, and can be stopped more quickly than the gasoline vehicle, with the added economic value of much cheaper operation."

To call public attention to the hearing, two electric buses which the company has had constructed were brought

down to Park Row near the City Hall and Mayor Kline and several of the city officials took short rides.

Boston Vehicle Meeting.

A joint meeting of the Electric Motor Car Club of Boston and the New England Section, Electric Vehicle Association of America, was held at Hotel Thorndike, Boston, November 14. Final plans for the Electric Automobile Salon to be held this week were discussed and reports of committees were received. Members of clubs and students in private schools whose tuition is above $200 per year were recipients of invitations to the salon. The lighting companies of New England were reported to be taking an active interest in the affair and devoted liberal advertising space in local newspapers to announce its attractions.

Resolutions of appreciation of the services of H. F. Thomson and E. S. Mansfield in promoting the activities of the club were adopted. The next meeting will be a Christmas celebration, with appropriate festivities.

The New England Section then took up its order of business, President J. E. Hunnewell of Lowell presiding. F. J. Stone advocated the holding of the next meeting in Providence, instead of Boston, and it was voted to accept the invitation of Mr. Davenport of the Narragansett Company of that city.

President Frank W. Smith, of New York, president of the Electric Vehicle Association of America, then addressed the gathering. He reviewed the fourth annual convention of the Association recently held in Chicago, praising the work of the Chicago Section, the activities of the Commonwealth Edison Company and of other Chicago workers. The membership now is 495, an increase of 57 per cent in the past year. Mr. Smith urged the need of team work on the part of committees. It is hoped to double the membership within a year.

Members were present from Providence, Lowell, Malden, Lynn, Worcester and other New England centers. Besides the speakers mentioned, L. D. Gibbs, E. S. Mansfield, and several others addressed the meeting.

Boston's Electric Auto Salon.

An exhibition of electrically driven motor cars for passenger use, under the auspices of the Electric Motor Car Club of Boston, was held Monday, Tuesday and Wednesday of this week at the Copley-Plaza Hotel, Boston. The ball-room, elegantly decorated with chrysanthemums, was the setting for the display of the cars, which were arranged in three rows, there being 29 vehicles, of nine different makes, as follows: Bailey, Baker, Buffalo-Babcock, Detroit, Ohio, Rauch and Lang, Standard, Waverley and Woods. Exhibits of groupings of batteries of Edison, Exide, Harvard and Philadelphia manufacture were arranged at the end of the room.

About ten thousand invitations were issued to electric car owners and prospective purchasers in Boston and vicinity and also in the principal cities of New England, the latter being distributed by central-station men in the various cities. The response was exceedingly gratifying, there being visitors constantly during the hours when the Salon was open, from 10 a. m. to 11 p. m.

Members of the Reception Committee met the visitors and assisted them in examining the exhibits. Each visitor was given a catalog which fully described each of the cars exhibited. The use of souvenirs or ciculars was closely restricted to such high-class productions as were in keeping with the character of the exhibition. The charge of an admission fee of one dollar served to keep the affair free from curiosity seekers and souvenir hunters. A distinctly "society" cast was attained in the conduct of the Salon, the end achieved being the arousing of interest in the electric automobile among the people of means.

Several teas were given by a women's committee consisting of the wives of members of the committee in charge.

Another Run in Bailey Roadster.

J. S. Codman, sales manager of S. R. Bailey and Company, of Boston, who has been for a couple of weeks in Chicago, recently completed a trip to Milwaukee and back to Chicago in one of the high-speed Bailey electric roadsters.

Having business to transact in Milwaukee, Mr. Codman took the same roadster in which Col. Bailey made his remarkable run from Boston to Chicago last month, and started Sunday, November 9, for Milwaukee, entirely undaunted by the furious northerly gale which blew all day and which was so destructive to shipping on the lakes.

Mr. Codman, accompanied by Harry Salvat, of the Fashion Garage, Chicago, left the Auditorium Hotel at 9:09 a. m. and ran into Waukegan, 45.5 miles, at 12:02 p. m. The best road was missed, adding about five miles to the distance to be covered and necessitating the passage of poor roads. After a wait at Waukegan for lunch, where a small charge was given the battery, the trip was continued at 1:32 p. m. and the 16 miles to Kenosha covered in 70 minutes, arriving at 2:42 p. m.

At Kenosha a charge was taken at the astounding rate of 200 amperes, which enabled about 50 miles worth of current to be put into the battery in one hour, and resulted in the battery arriving at Milwaukee with a big surplus of current still available. The car left Kenosha at 4:00 p. m. and after some difficulties in finding the way, and in spite of the gale and heavy roads, arrived safely at the corner of Wisconsin and Water Streets, Milwaukee, at 6:17 p. m., covering 34.7 miles in two hours and 17 minutes.

Mr. Codman made the trip back to Chicago by himself, leaving Tuesday morning, November 11, at 8:25 a. m. and stopping only at Kenosha for another high-rate charge. He arrived at the Illinois Athletic Club, Chicago, at 4:19 p. m., having covered 98:8 miles for the day.

Electrification of London and South Western Railway.

Work on the London and South Western Railway Company's scheme of electrification of its suburban lines has been commenced at Teddington, and a few notes descriptive of the scheme will be of interest.

The power house will be situated at Wimbledon, adjacent to the main line. The building will consist of two main bays forming a boiler house and turbine house, with a switch house attached, and will be 260 feet long by 210 feet wide. There will be two chimney stacks at the west end, each 236 feet high and 13 feet 6 inches internal diameter.

The boiler house will contain, when completed, 24 boilers, each capable of a normal evaporation of 20,000 pounds of water per hour, and supplying steam at a pressure of 200 pounds per square inch, and with a superheat of 200 degrees Fahrenheit.

Coal from the overhead bunkers will descend through shoots into mechanical stokers driven by electric motors.

The turbine room, when completed, will contain six steam turbines coupled to 5,000-kilowatt three-phase alternators, which will run at 1,500 revolutions per minute, and will generate current at 11,000 volts.

There will also be two auxiliary steam turbines coupled through gearing to 400-kilowatt direct-current dynamos for supplying power for the power-house lights and auxiliary motors.

The switch house will have three floors and will contain all the switchgear for controlling the main generating plant and the outgoing feeders. The main oil switches will be controlled from a desk erected on a bal-

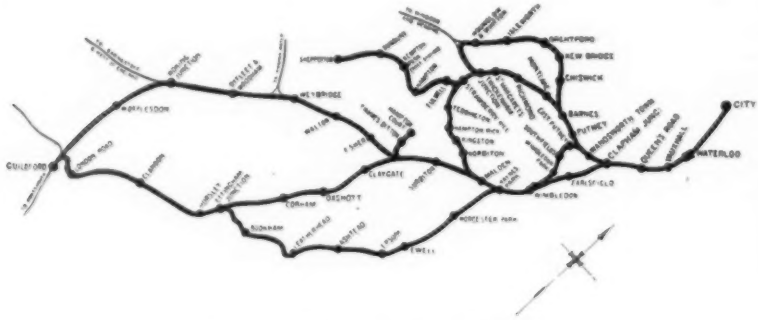
cony on the first floor of the switch house overlooking the turbine house and will be electrically operated.

Below the turbine house there will be a basement which will contain surface condensers, with the necessary air and circulating pumps, together with ten hot wells and boiler feed pumps.

A 40-ton overhead electric travelling crane will span the turbine room for overhauling purposes.

The current generated at 11,000 volts at the power house will be transmitted to nine substations by three-core cables. These cables will be paper-insulated, lead-sheathed and wire-armored. They will in most cases be supported on poles beside the line and will be so arranged as to afford a duplicate supply to every substation.

Substations will be erected at Waterloo, Clapham Junction, Raynes Park, Hampton Court Junction, Barnes, Twickenham, Kingston, Sunbury and



Lines of London and South Western Railway.

Isleworth. The buildings, with the exception of that at Clapham Junction, will be 50 feet wide and from 65 to 103 feet long, and will consist of a machine bay and a switchgear bay. Each substation will contain static transformers and rotary converters, together with the necessary switchgear, for transforming the three-phase, high-tension current to direct current at 600 volts, in which form it will be used by the trains. Two sizes of converters will be used, the larger having a continuous capacity of 1,875 kilowatts, at Waterloo (4), Clapham Junction (3), Raynes Park (2), Barnes (2), and Twickenham (3), and the smaller, having a continuous capacity of 1,250 kilowatts, at Hampton Court Junction (2), Kingston (2), Sunbury (2), and Isleworth (2).

From the substations, direct current at 600 volts will be delivered to a conductor rail which will be laid along the line sixteen inches from gauge and at such a height that the contact surface will be three inches above rail level. The rail, of which considerable quantities have been delivered, is of special steel having a resistance about 6.75 times that of copper of the same length and cross-sectional area, and weighs 100 pounds per lineal yard. It will be supported by insulators fixed on the sleepers and will be bonded across the joints by four flexible copper bonds expanded into holes drilled in the rails before delivery.

Current will be collected from the rail by the trains by means of cast-steel collector shoes hung from the trucks, and the return side of the circuit will be formed by the running rails, which will be bonded across the joints by two flexible copper bonds.

For the first section of the electrified lines, 84 train units are being provided. Each unit will consist of three compartment-type coaches and will be equipped with four motors, each of 275 horsepower, together with the necessary control apparatus. These motors will be the largest ever mounted on a passenger coach. A special motor truck, carrying two motors, will be fixed under each end of the train unit, the remaining trucks being of the Company's standard pattern.

The control apparatus will be of the relay automatic multiple-unit type providing for uniform acceleration, and controlling from the front driving cab all the motors on a train of any number of cars.

Every train unit will have a driving cab, containing control apparatus for two motors, at each end, two baggage cars and seating accommodation for 190 passengers.

New running sheds and repair shops for the electric trains will be built at Wimbledon, adjacent to the power house, and additional sheds will probably be provided at Hampton Court, Fulwell and Hounslow.

It is the intention to commence electric working on the Kingston Roundabout line first, and it is hoped that this line will be in operation before the end of next year.

Electric services on the Hampton Court and Shepperton branches and on the Hounslow Loop line will be added as soon after the initial installation as possible.

OPENING CELEBRATION OF THE CHATTANOOGA & TENNESSEE RIVER POWER COMPANY'S HYDROELECTRIC PLANT.

Notable Gathering Present at Dedication of Largest Power Project in South.

More than a quarter century ago there was conceived in the mind of a Chattanooga business man the idea of building a gigantic power plant on the Tennessee River that would generate power to turn the wheels of the diversified manufacturing plants of the city and light the stores and homes of those who live there. Later this man was given the opportunity to proceed with his ideas and he succeeded in interesting sufficient capital to build what has come to be known as the most important engineering project of the South—the Hale's Bar development of the Chattanooga & Tennessee River Power Company. On Thursday, November 13, this development was formally dedicated, under auspices that will distinguish the day as one of the most important in the history of the city.

As soon as it was definitely known that the completion of the project was in sight, the local Chamber of Commerce, under the leadership of Paul J. Kruesi, planned a fitting ceremony that would be in accord with the importance of the development to Chattanooga. Invitations were sent to prominent engineers, manufacturers and others who might be interested in the development of the South and the ready response to these invitations was highly gratifying to the committees having the affair in charge.

The exercises of the day were simple and impressive, the most important function being the throwing of the switch at the power house which started the plant in operation. This was performed by two granddaughters of the late A. N. Brady and was witnessed by an assembly of over 520, who made the trip down the Tennessee River.

The trip to the plant was made by boats. Promptly at 9 a. m. the steamers *James N. Trigg* and *Joe Wheeler*, loaded to their capacity, sailed from the Market Street wharf, amid the cheering of thousands of citizens who lined the banks of the river.

As the steamers drew near the lock and dam they were met by a flotilla of gaily-decorated motorboats which lined across the river and greeted them with a salute of shrill whistles. Falling into line with the steamboats, the boats accompanied the party to the landing near the power house.

At the power house a buffet luncheon was served to the party, tables being set in the generating room. Following the luncheon Paul J. Kruesi, as master of ceremonies, introduced a few speakers from among the visitors. These included Governor Hooper of Tennessee, Mayor Thompson of Chattanooga and John A. Patten, all of whom spoke of the possibilities of the power plant in the future progress of Chattanooga, lauded the energy and spirit of the men who conceived the idea of the dam and financed it, and praised the genius of the engineers who carried it to a successful completion over the many obstacles which presented themselves.

At 3:30 o'clock the entire party entered a special train of eight coaches at the lock and dam station, and traversing the "Dam" railroad to the main line of the Nashville, Chattanooga & St. Louis Railroad at Ladd's, over which it traveled the remainder of the distance, arriving in Chattanooga a little after 4 o'clock.

Leaving the train, the party then entered automobiles and special cars of the Chattanooga Traction Company's line and went to Signal mountain, where the banquet, which was the culmination of the day's celebration, was held.

At the banquet toasts were responded to by Nicholas Brady, John Bogart, T. E. Murray, Governor Hooper and others.

A complete description of the lock, dam and power house appears elsewhere in this issue.

Water Power at the Conservation Congress.

The fifth annual National Conservation Congress was held in Washington this week, unusual attention being devoted this year to the subject of water power. The speakers on this subject included Gifford Pinchot, Senator Burton of Ohio, Senator Newlands of Nevada, and others, the Water Power Committee of the Association being composed of former Secretary of War Henry L. Stimson, Representative A. F. Lever, Gifford Pinchot, Lewis B. Stillwell, Charles R. Van Hise, M. O. Leighton, E. S. Webster, B. M. Hall and Joseph N. Teal.

George F. Swain, professor of Civil Engineering at Harvard University, and president of the American Society of Civil Engineers, presented the Water Power Committee's report. It presented constructive suggestions.

The address on this subject delivered by Gifford Pinchot was in part as follows:

"We need and we are going to have immediate water-power development on terms fair to the public. This is the greatest necessity in the whole water-power situation, and the next great step in conservation. For it the conservationists have worked unceasingly during the last ten years and more.

"We cannot have water-power development upon terms fair to the public if the water-power interests hold the public at their mercy through unregulated or ineffectively regulated monopoly. Is there serious danger on a national scale that such a situation may arise?

"Figures compiled by the United States Bureau of Corporations and brought up to date by the National Conservation Association show beyond question that the central fact in the water-power situation is concentration of control. Concentration in water power has nearly doubled in the last two years. The ten greatest groups of water-power interests today control nearly twice as much water power as the ten greatest groups of two years ago controlled then. The ten greatest groups of today control 65 per cent of all the developed water power in the United States, and a single group, composed of the General Electric interests, controls 40 per cent of all the developed commercial water power in the United States.

"In the last five years the concentration of control in the ten greatest groups has increased about seven times faster than the total of all water-power development in the United States. The ten greatest groups have increased their control of undeveloped power in the last two years more than twice as fast as their control of developed power. In ten states one company, and in seven states two companies, control from 42 to 96 per cent of all the developed commercial water power, and in 15 of these 17 states every one of these companies was organized or reorganized within the last three years. If this is not monopoly in the making, where can it be shown? Commercial power to this degree is political power, and there lies the greatest danger.

"It is argued that concentration of water-power control is increasing faster than power development, because high risks and low returns keep capital away. But according to the figures published by one of the ten greatest groups of power interests, in the last ten years the net earnings of the gas and electric companies of the United States have never dropped below 8 per cent as against 4.25 per cent for railroads and 7.79 for industrial corporations. As shown by the annual amount of securities in receivers' hands per one hundred dollars of outstanding securities, the water-power interests are nearly five times safer investments than railroads, over five times safer than industrial corporations, and about as safe as national banks.

"The control of any source of mechanical power—coal, oil, natural gas, water—carries with it control over the industries which require the power, as the rapidly increasing domination of water-power interests over electric-light and street-railway companies well illustrates.

"Under these circumstances, we should expect to find, and we do find, that the control of the water-power business, like the control of the oil business, the meat business, and the anthracite coal business, is passing into a few strong hands. Like coal, meat, and oil, mechanical power from falling water is a necessity of modern life. Control over a necessity of life is control over the people who must have that necessity. Private monopolization of any necessity of life means private control over the people without responsibility to the people.

"It means also the power to increase the cost of the necessaries of life, and therefore the cost of living, without regard to the public interest, up to whatever point will yield the largest profit.

"Will full protection to the public interest check development? The commonest and most plausible argument of certain water-power interests is that it will. The conclusive answer is that in actual practice it does not.

"Under the regulations of the Forest Service, which include also the very provisions so vigorously objected to by certain power interests as sure to hamper development, there were on the national forests, on October 1, 1913, 78 water powers developed, 30 under construction and no less than 76, of 728,300 horsepower capacity at low water, for which permits have been taken out within the past two years, under conditions requiring prompt development. The total capacity of all these powers is about 1,090,000 horsepower reckoned on minimum stream flow, or not less than twice that amount in actual fact. These figures finally and completely disprove the claim so often heard that proper government regulations check development."

The old state's rights quarrel came up at the Congress. Secretary Lane plead for co-operation between the State Conservation Commission and the Federal Government. He spoke particularly of an investigation now being made jointly by state and federal Government to determine what amount of power can be developed along the Columbia River, and instanced that as a case in which co-operation is shown to be invaluable. Nothing can be done, he said, without the co-operation of state and federal Governments.

New Electrical and Mechanical Appliances

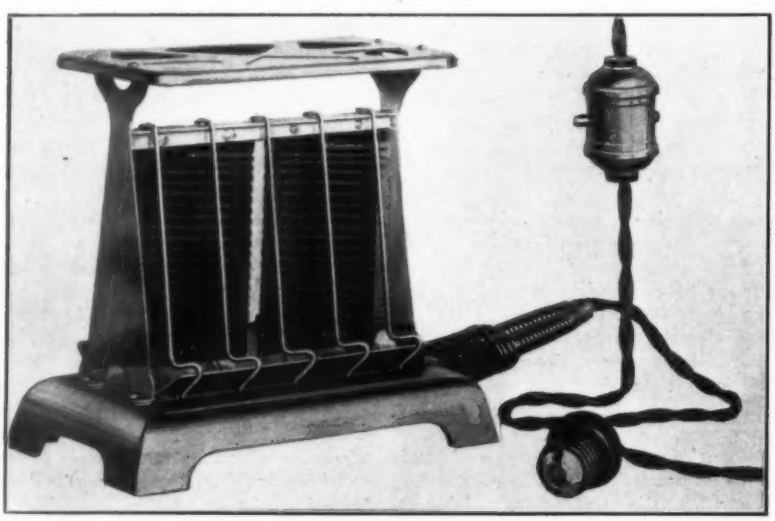
The Westinghouse Vertical Electric Toaster.

The rapidly increasing popularity of electrical devices for cooking has resulted in the introduction of a number of economical devices for the table and in the home. One of the latest devices is the Westinghouse electric vertical toaster which has just been placed on the market by the Canadian Westinghouse Company, Hamilton, Ont. This little device, as shown in the accompanying illustration, besides being beautiful in appearance, is exceedingly economical in operation. The toaster is designed and finished for use on the dining-room table; all parts are nickel-plated and highly polished. It toasts two pieces of bread at once and has a place on the top where the toast may be kept hot.

It has a record of 6,000 hours for toasting. This means it is capable of making eight pieces of toast every day for almost 100 years. The heat element is practically indestructible, being made of Nichrome, a non-oxidizing and non-rusting alloy.

The high efficiency of this little device is increased by a reflector at the base of the toaster which rests on an insulating asbestos board protecting the base from direct heat radiation or conduction. This construction enables the toaster to be used on an uncovered table without fear of damaging the finish of the wood. It can be used, therefore, wherever there is an electric light fixture.

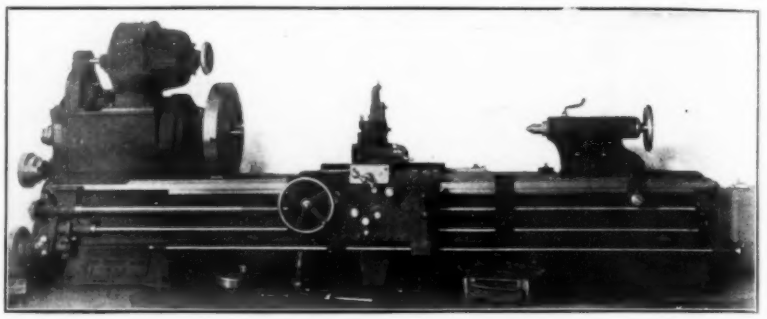
The toaster weighs slightly less than 2.5 pounds and is seven inches in height. Its current consumption is 550 watts at 110 volts, and two pieces of toast can be made thereon in less than three minutes. The toaster is furnished complete with a silk cord and attachment plug. A feed-through switch is provided when desired.



New Westinghouse Toaster.

Motor-Driven Heavy-Duty Lathes.

The 27-inch motor-driven lathe shown herewith, and a similar 18-inch lathe are products of the Reed-Prentice Company, Worcester, Mass. These lathes are specially designed and built to withstand the strain of constant heavy turning, and are adapted for railroad and all kinds of heavy work. The machines are equipped with quick-change gear boxes, which are easily operated, giving, on the 18-inch machine 60 changes, and on the 27-inch machine 54 changes to both lead screw and feed rod.



Twenty-Seven-Inch Motor-Driven Lathe.

There are three reductions of motor speeds by gearing, and ten changes in controller, giving in all 30 spindle speeds. The fastest and slowest spindle speeds on the 18-inch lathe are 360 and 15 revolutions respectively, while those obtained on the 27-inch machine are 172 and 5.5 revolutions. The headstocks, as may be seen, are of massive proportions. The apron feed works are driven by worm and gears. There are double frictions for lengthwise and cross feeds. The lead screw is equipped with thread-cutting index.

The machines are driven by semi-inclosed Westinghouse motors, of 3 and 11.5 horsepower for the 18 and 27-inch types, respectively. The hand wheels shown on the end of the motor shafts are used to turn the face plates in chucking the work to be machined.

Two Useful Testing Instruments.

Commercial testing methods have received a considerable amount of attention with the result that some specialized equipments of very interesting design are now to be found. In the maintenance of power installations, such as are found in tramway systems, factory installations and similar equipments, the need has frequently arisen for a simple method of detecting internal short-circuits in field coils, armatures, stators, rotors and other windings. The detection of internal short-circuits is,

of course, a very difficult matter, and without special apparatus it is frequently necessary to pull down the whole winding before a defect can be located. In tramway circuits the gradual and continuous deterioration of the insulation of the field coils is responsible for a steady rise in the energy consumption per car-mile and it is obvious that systematic examination and the periodic testing, repair or re-insulation of this part of the equipment will effect a marked reduction in the power costs.

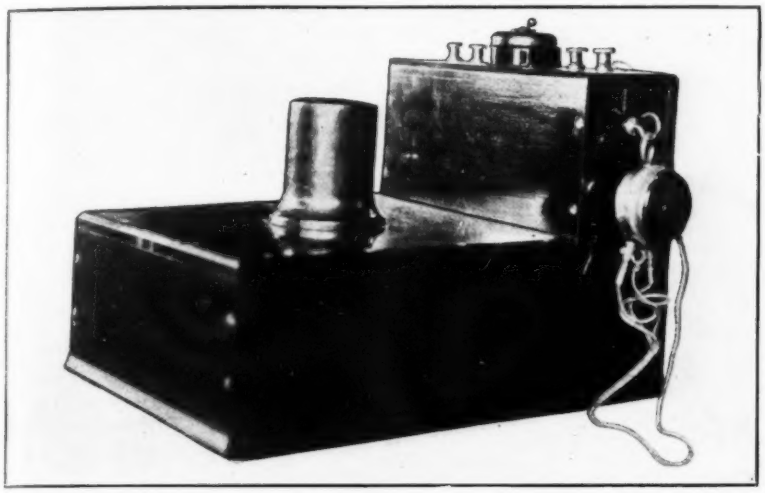


Fig. 1.—Simpson Coil Tester.

Hitherto, however, the ordinary methods of carrying out such tests involved the use of special plant, including an alternator and transformer, and the considerable capital outlay involved naturally limited the number of undertakings that could make use of such an arrangement. Moreover, such an apparatus requires an expert to use it, or else the results might easily become unreliable.

To meet this need, a very interesting instrument has now been designed, known as the Simpson coil tester, which is illustrated in Fig. 1. This provides, at a reasonable cost, the means of making a rapid and accurate test of coils of any type and embodies the well known principle of the Hughes magnetic current. In the teak case shown there are the balance coils, condenser, etc., and it is fitted with a projecting coil and core. The terminals of the instrument are connected to any direct-current lighting circuit with a lamp in series, or to any alternating-current lighting circuit without the lamp. The current is then switched on and a faint buzz indicates that the instrument is ready for use. The coil to be tested is placed on the base board with the projecting core approximately in the center. A telephone receiver may be held to the ear of the operator, although this is not usually necessary. If the coil is sound no alteration in the note is observed, but if there is a short-circuit in the coil, there will be a mutual induction between the coil which is being tested, and the coil of the magnetic balance, with the result that the balance is disturbed and a loud musical note is set up in the receiver. Moreover, the intensity of the sound is some indication of the number of turns which are short-circuited. It will be noted that no connections are made to the coil that is being tested, nor is the coil prepared in any way for the test. Hence the test can be made rapidly and accurately and, as the indications of a short-circuit cannot be mistaken, anyone can use the instrument.

It will be seen how useful this tester, which is made by Messrs. Dryers, Limited, of Manchester, England, is in factory practice. All coils can be tested both before and after treatment in the dry insulating machine, in order to make sure that there are no internal short-circuits before the coils have been assembled in the motors, dynamos, transformers or other apparatus. In the repair shop each coil can be tested as it is removed from the apparatus under repair before putting it into the dry insulating machine for treatment, and again tested after treatment before replacing it on the machine. When the coil passes these tests, it is a guarantee that the insulation is as perfect as possible. A coil which fails to pass either test should be replaced with a new one. The testers can be arranged either for 200 to 240-volt lighting circuits, or for tramway circuits of 500 to 550 volts, or for alternating current, and a fourth type can be worked by an accumulator.

Another valuable instrument which is made by the same firm is shown in Fig. 2. This is the Brown armature and stator tester for dealing with internal short-circuits in armatures, stators, rotors and coils. The Simpson tester just described is useful for testing independent coils, but when these coils are made up in complete armatures, rotors and stators, the problem presented is rather more difficult. The Brown armature tester comprises a heavy bed with adjustable roller supports to suit

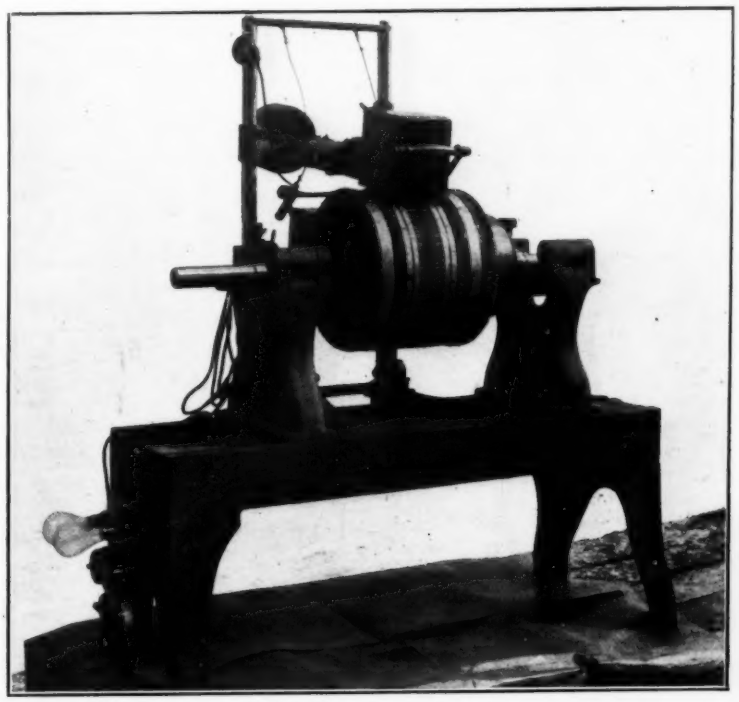


Fig. 2.—Brown Armature Tester.

tector, and a telephone receiver. The inductor is connected to any available source of electric supply, such as the lighting circuit, or to a portable battery, and serves to induce an electromotive force in the armature coil immediately beneath its poles. If there is an internal short-circuit in that coil a current flows, which, through the detector, causes a loud noise in the telephone receiver that cannot easily be mistaken.

No connections are made to the armature which is being tested. The armature is moved slowly around under the detector until all the coils in turn have passed the inductor. Every coil which is internally short-circuited will thus be detected and may be marked so as to enable the workmen to distinguish it and put the work right later. In addition to indicating short-circuits in the coils, this arrangement will also detect short-circuits between commutator bars if the armature coils and the commutator have already been connected up ready for use.

It is therefore apparent that this instrument is of value in detecting the effects either of careless winding, whereby the original insulation or wrapping of the wire is abraded, also of careless handling, either in transport or in assembling the coils in their place, and also where the machine has been used and overheated, whereby the original covering of the wire is charged and rendered a conductor. In view of the serious loss which frequently occurs through internal short-circuits, and the difficulty of detecting such troubles before the coils are put into service, the special instruments here described and illustrated on the preceding page are particularly interesting.

Accurate Control of Giant Floating Cranes.

The accompanying illustration shows one of two new pontoon cranes recently made for the United States Navy Department by the Wellman-Seaver-Morgan Company. One of these 150-ton cranes is for Boston Harbor and one for Pearl Harbor, Honolulu, and both are to be used for unloading to lighters where good harbor facilities are lacking and for handling, removing or replacing such machines and apparatus as turrets, boilers, guns, etc., on battleships. Two of the rigid tests made by the Navy Department engineers before acceptance and referred to below are an indication of the accuracy of control provided by the magnetic type controllers that were installed by the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis.

United States Navy 150-Ton Pontoon Crane, Boston Harbor.

In order to test nicety of landing heavy weights, the weight was suspended over an empty oil can with a block on top of it, and then lowered so as to strike the block, being stopped upon signal. It was possible to stop the load without injuring the oil can or deforming it. In order further to test this point, the weight was suspended about two inches over the block and then lowered to see how close it could be brought without touching, and was brought within one-sixteenth inch of the block.

Two 45-Ton Electric Industrial Locomotives for Connecticut Company.

The plant of the Chase Rolling Mill Company, Waterbury, Conn., is located about 1.5 miles from the nearest railroad track and at an elevation considerably above the railroad. Heretofore all the hauling of raw material and finished product to and from the station has been handled by eight-horse teams. This proved to be very expensive, costing at least 50 cents a ton.

To replace these teams an electric line of 2.3 miles length, with a maximum grade of five per cent was built from the railroad to the mill. Two Baldwin-Westinghouse 45-ton electric locomotives were then employed to handle the work formerly done with 20 eight-horse teams. Each locomotive is equipped with four Westinghouse 100-horsepower, 600-volt motors and type

Forty-Five-Ton Industrial Locomotive.

HL control. The control equipment of these locomotives is mounted in the center of the locomotive and surrounded by an expanded-metal screen cage. One departure from the usual construction followed in locomotives is that the motors are "outside" instead of "inside" hung. This arrangement was necessary in order to give the trucks a short wheel base so as to enable them easily to negotiate the sharp curves to be encountered.

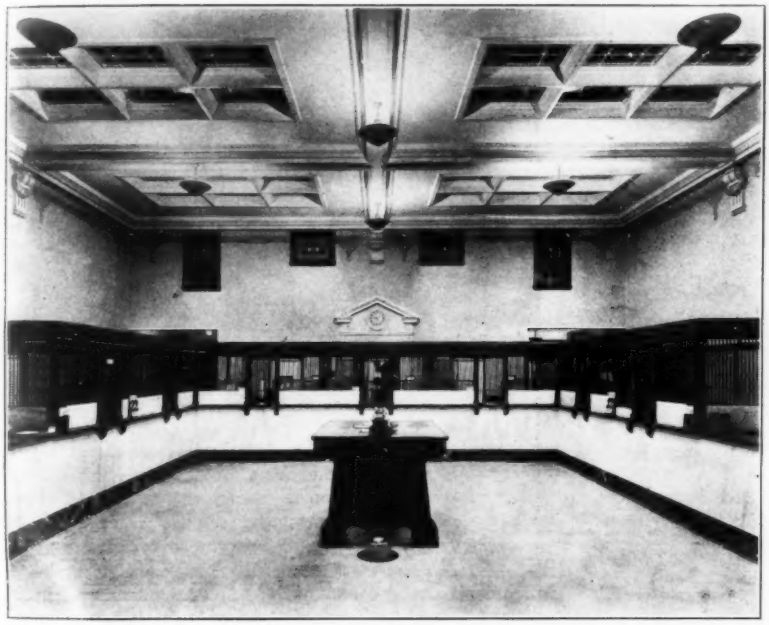
The locomotive makes from eight to ten trips per day and with a load of approximately from 100 to 125 tons each. This load is governed by the five-per-cent grade previously mentioned, which is 3,000 feet in length. These locomotives have been in operation since the first of the year and have had a perfect record, having given no trouble whatever.

The same engineer has the same locomotive every day and is responsible for its condition. These men are perfectly competent to make ordinary inspections and to keep the apparatus cleaned and oiled. In addition to this, at stated periods of approximately one month the machines are thoroughly inspected by the men in the repair shop. Aside from this no other work has been done since the locomotives have been put in service and nothing has been spent on repairs.

Indirect Lighting of Aberdeen National Bank.

In the design of bank buildings the aim is usually to produce an imposing structure which shall be a credit to the community architecturally. In keeping with this idea there is generally provided a lighting equipment, in the main banking room of the institution at least, that is calculated to appeal to the public as being exceptionally fine, either on account of the beauty of the fixtures or of the excellence of the general illumination produced. Coincident with this, however, is too frequently an inadequate illumination of the tellers' windows and clerks' desks with the result that an array of more or less satisfactory desk lamps and brackets is needed to supplement the general lighting. Much of this auxiliary lighting is put in as an afterthought and is poorly planned, expensive and productive of very uncomfortable glare.

An installation in which this difficulty is entirely overcome is in the Aberdeen National Bank, Aberdeen, S. D. A new and classically beautiful building has been erected for this institution in which every possible consideration was given to the comfort and welfare of the employees as well as the patrons of the bank. The accompanying illustration gives some idea of the main banking room. In dimensions this room is 52 by 48 feet, and the ceiling is 23 feet above the floor. A light greenish tint is used for the walls and ceilings; this harmonizes well with the mahogany woodwork, the bronze grillwork and the marble wainscoating under the tellers' windows.



Interior of Aberdeen National Bank, Showing Six of the Indirect Lighting Units.

An indirect lighting system was decided on for this room. Seven Alexalite units of Lotus design finished in antique ivory were selected for mounting from the center of the beams that divide the ceiling into six large panels, as shown. The bowl of the indirect unit is 24 inches in diameter and is hung so that its upper edge is 18 inches from the surface of the beam. Eacn unit contains a 250-watt tungsten lamp, thus the power consumption is only about 0.7 watt per square foot and yet the illumination is said to be close to five foot-candles on the working plane. So uniform and satisfactory is the illumination that no desk lamps or other auxiliary light sources are needed in any part of the room. The clerks working on desks around the edges of the room find the illumination abundant and very comfortable, since glare is entirely eliminated.

Several smaller rooms adjoining the main counting room are set apart for the directors and executive officers of the bank. In these rooms the illumination is provided by six 150-watt Alexalite fixtures, usually one to each room. These units are of Louis XIV and Gothic design and are finished in antique gilt. They also provide abundant illumination so as to dispense with supplementary lighting.

The new bank building was designed by Buechner & Orth, of St. Paul, Minn., architects. Current is supplied by the Aberdeen Light & Power Company, which also installed the fixtures that were furnished by the Central Electric Company, of Chicago.

Westinghouse Machine Company Increases Manufacturing Facilities.

At a recent meeting of the Executive Committee of the Westinghouse Machine Company an appropriation of $125,000 was made to provide additional manufacturing facilities.

The additional equipment is required to take care of the rapidly increasing business which the Westinghouse Machine Company has been enjoying recently, owing in a large measure to the new lines of products developed, particularly the following: the impulse turbine, which is being used in large numbers by central stations, railways and industrial plants; the reduction gear, which in addition to the demand for marine installation, is finding a wide field of application in connection with the large direct-current generators. The gear is interposed between the high speed of the turbine and the low speed of the direct-current machine with its commutator. Orders for automobile rotary valve motors have also contributed to increasing need for additional equipment.

The department manufacturing air springs for automobile trucks has also felt the influence of increased business and additional manufacturing facilities are required for it. These springs are interposed between the chassis and the body of the truck and thus very ma-

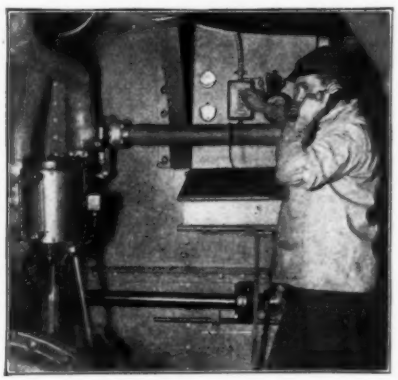
terially reduce the jar and vibration. They have proved exceedingly popular for this class of vehicle.

The company contemplates devoting a portion of the appropriation to securing additional machine tools designed to use high-speed tool steel, fully realizing their advantages, and thus adding to the already well equipped shop which this company now has in operation.

Intercommunicating Telephones on Shipboard.

The use of the telephone on shipboard has until a very short time ago been confined to large passenger boats, privately owned yachts, and warships, however, according to the *Western Electric News*, a recent installation of intercommunicating telephones on the ocean-going tug *Perth Amboy* of the Lehigh Valley Railroad Company's fleet has proven the practicability of these space and time annihilators in commercial ship service.

Inter-Phone in Wheel House.



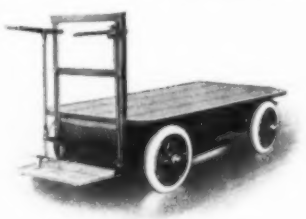
Inter-Phone in Engine Room.

The necessity for an installation of this kind is probably best told in the words of Captain Harry Farnham, a typical old-school skipper, who is in command of the *Perth Amboy*. Captain Farnham said: "I never believed in putting telephones on a boat like this and you couldn't get me to use the things when they put them in. Didn't think they were seaworthy. Then something happened to make me change my mind and mighty quick, too! We were pulling along off the Main coast with a long tow of coal barges when we struck the worst sou'wester I've run into in my thirty years of sea going. I wanted to tell the engineer something—something important that my signal bells couldn't tell him. You couldn't hear a sound through the tube, so I started to send the cabin boy down with the message. But the sea was too high and I was afraid he'd be washed over the side. Without knowing it, I found myself using my Inter-phone and all of the next few days while we were riding out the gale I used that thing all the time. You could understand everything in spite of the racket made by the wind and engines. Pretty hard to teach an old sea-dog new tricks, but I'm glad I learned that new one. Now I wouldn't be without it."

The Hunt Storage-Battery Industrial Truck.

The Hunt storage-battery industrial truck is illustrated in the accompanying photograph. This new truck, built by the C. W. Hunt Company, Incorporated, of New York, is designed for conveying heavy material around manufacturing plants, steamship and railroad terminals, etc., where it can be run with the utmost flexibility; it can be put on elevators and conveyed to different floors, and it can be run directly into box cars, which would be well nigh impossible with a system of tracks.

These trucks are very compact and have a capacity of approximately 4,000 pounds. With this load, the maximum speed is about five miles per hour. The storage capacity of the batteries is ample for an ordinary full day's working.



Storage-Battery Industrial Truck.

Either Edison iron and nickel cells or Exide lead cells are supplied. The storage-battery cells are incased in a battery box of heavy steel, suspended by springs from the cross members of the frame. The entire section of the top of the truck over the battery box is removable, thus making the batteries readily accessible.

The motor is especially designed for service with storage batteries, and drives the wheels through a differential cut-steel gearing, all inclosed in an oil and dustproof housing. Ball and roller bearings are used throughout.

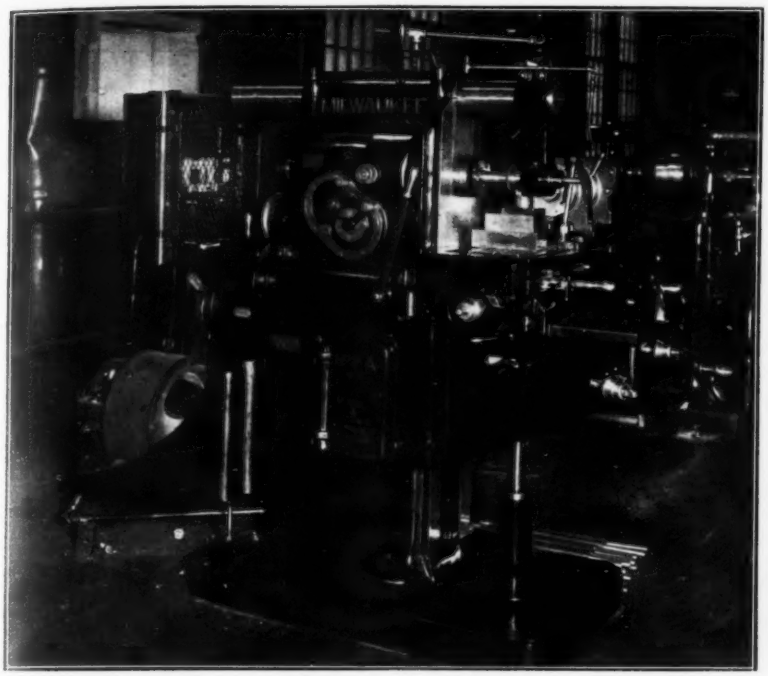
The operator's platform is at the front of the truck, as shown, from which the truck is steered by the right-hand lever. The other level controls the motor and the brake is actuated by the pedal. When not in operation, the truck is always locked.

Ferrochrome Electrically Produced.

A new industry has been started at Trollhattan, Sweden, in which the electric furnace is used for the reduction of ores brought from South Africa and New Caledonia. Two furnaces are now in operation, using three-phase, 50-cycle current at a voltage varying between 45 and 60. Four grades of metal are being made, containing 5, 6.5, 7.5, and 9 per cent of chromium, and the finished product is shipped to various European countries. The process is a secret one and owned by the Ferrolegeringar Aktiebolag. The output for the year 1913 will reach about 1,200 metric tons and this will be increased in 1914 to 2,500 tons, with further extensions in 1915. It is stated that the furnace requires 1,700 kilowatt-hours per ton of metal reduced and that the results thus far obtained are entirely satisfactory in every way.

The First Diesel Locomotive.

About two years ago, it was announced that Sulzer Brothers were co-operating with the late Rudolph Diesel in the design and construction of a railway locomotive to be operated by Diesel oil engines. During the present year, the locomotive has been completed and put into trial service. It has been constructed to the order of the railway department at Berlin for the Prussian-Hessian State railways.



Motor-Driven Constant-Speed Milling Machine.

Constant-Speed Milling Machine.

The accompanying illustration shows a motor-driven milling machine manufactured by Kearney & Trecker Company, Milwaukee, Wis., and especially designed for heavy duty and fast cutting. The machine is automatically lubricated, the gears and bearings being constantly flooded with oil by means of a simple pump from a reservoir in the base. It is also equipped with a pump for lubricating the cutters, means being provided for returning the lubricant from the work-table to the reservoir.

Constant-speed drive is used exclusively on this type of machine on account of its superiority as a means of driving milling cutters of varying diameters. No countershaft or overhead belts are required and the pull at the periphery of the cutter is the same at any given surface speed regardless of its diameter, while in any variable-speed drive the power diminishes, due to the slower belt speed, as the size of the cutter is increased and at a time when it should be at a maximum. The column is a heavy and massive one-piece casting with strong internal ribs, rendering masonry foundations unnecessary where the floor is strong enough to carry the load.

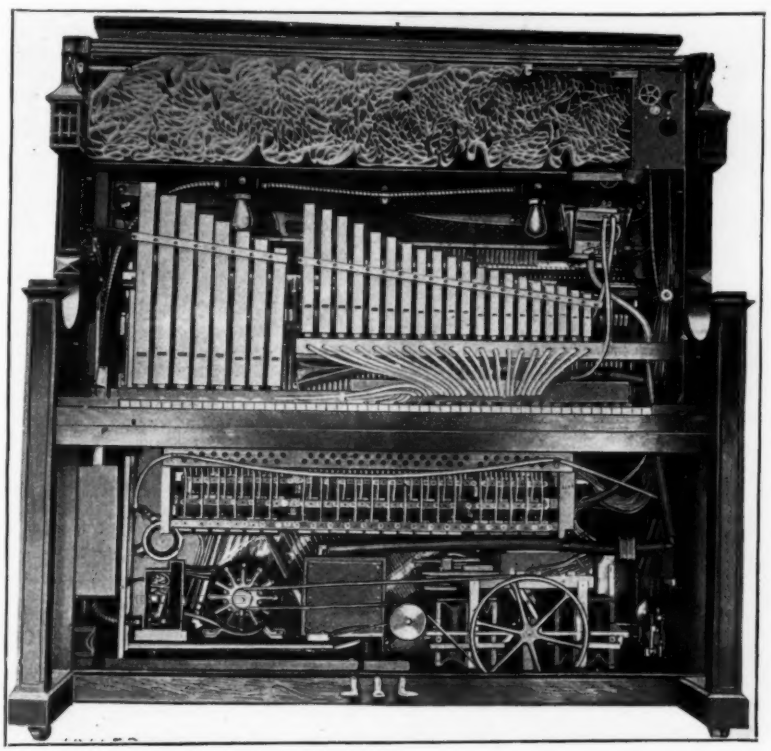
The drive shafts and gears are all of case-hardened steel. The knee is a box section, closed on top, which adds greatly to the power and rigidity of the machine. The work-table projects beyond the bearings and protects them from dirt and chips. The overarm is a solid steel bar, parallel with the spindle, to which the arbor supports are clamped. The arm braces form a tie between the arm and the knee and help to prevent their springing in opposite directions. The spindle is made of forged special steel and runs in bronze bearings, both of which are tapered. Jaw clutches are used. Self-contained means are provided for reversing the spindle, so that right or left-hand cutters can be used.

The machine is driven by a five-horsepower Westinghouse motor, which is mounted on the adjustable bracket. A pair of reducing gears to which the motor is connected is mounted inside the machine.

Motor-Driven Piano.

The motor-driven coin-controlled piano is a source of amusement to the patrons and of profit to the proprietors of cafes, clubs, refreshment parlors, etc. The illustration herewith shows a typical high-grade instrument and its interesting interior. The power is supplied by a small Westinghouse motor. A special type of motor is furnished for this service, which is especially suited for the work to be done, being quiet in operation and requiring almost no attention. The motor drives an air pump, which supplies air for operating the keys and also a stand of flute pipes. The music roll, which is contained in the upper part of the piano, is endless and will play from 15 to 20 tunes. Hence the piano has quite a repertoire with one filling. This piano is made by the Link Piano Company, Binghamton, N. Y.

Exports of copper during month of October totaled 29,007 tons as compared with 25,000 tons for the same month last year.



Motor-Driven Piano, Showing Interior Construction.

Latest Approved Fittings

CABINETS.—Greater New York Metal Box Company, 60 Grand Street, New York, N. Y.
Approved October 4, 1913.

FIXTURES.—The F. W. Wakefield Brass Company, Vermillion, O.
Approved October 2, 1913.

FUSES, Cartridge Inclosed.—D. & W. Fuse Company, Providence, R. I.
"Type C Baby" cartridge fuses, 3, 4, 5, 6, and 8 amperes, 250 volts; catalog Nos. 1723, 1724, 1725, 1726 and 1728.
Standard for use in rosettes and attachment plugs, and for use in protective devices for signaling systems.
Approved October 24, 1913.

FLEXIBLE CORD, Portable.—Imperial Wire & Cable Company, Limited, Montreal, Canada.
For electric heaters.
Multiple-conductor cords composed of loosely twisted wires with cotton wind, rubber and asbestos insulation covered with an open retaining braid and assembled as a twisted pair with an outside protecting braid over the whole.
Tag on coil to read: "National Electrical Code Standard."
Marking: Two yellow cotton threads cabled with copper strands.
Approved October 15, 1913.

INSULATING MATERIALS.—Insulating Materials Company, 805 to 821 Wesson Avenue, Detroit, Mich.
Black Insulating Wax No. 3.
This material has a melting point of approximately 218 degrees Fahrenheit, and may be used for sealing screw heads, nuts, bolts and other live metal parts of electrical fittings where such sealing is required by the rules of the National Electrical Code.
Approved October 15, 1913.

INSULATING MATERIALS. — The Continental Fibre Company, Newark, Del.
"Bakelite-Dilecto," Grades X and XX. A fiber material with a Bakelite binder. Laboratories' tests show that this material has good di-electric strength, is practically non-absorptive, can be readily worked with tools and is combustible to about the same extent as fiber.
Standard for use as a substitute for hard fiber as cross bars of knife switches, washers, bushings and other small parts where fiber has been accepted as standard.
Manufacturers desiring to use this material should submit samples in commercial form for tests.
Approved October 24, 1913.

"HUBBELL" CHAIN EXTENDERS FOR PULL SOCKETS AND RECEPTACLES.—Harvey Hubbell, Incorporated, Bridgeport, Conn.

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

Catalog Nos. 5828 and 5829; each consisting of a ring for clamping to the socket shell, with an extended arm supporting a pivoted lever to the ends of which are attached the socket chain and an operating cord.
Also "Economy" Attachment; catalog No. 5880, simliar to the above but arranged for fastening to the socket interior rather than clamping to the shell.
Approved October 15, 1913.

RECEPTACLES, For Attachment Plugs.—Federal Electric Company, Lake and Desplaines Streets, Chicago, Ill.
For Federal Sign System (Electric), sole agents, Chicago, Ill.
"Federal" screw-clamp type; 660 watts, 250 volts, catalog No. 370.
Approved November 3, 1913.

SIGNS, Electric.—Electrical Products Corporation, 1112-1116 West Sixteenth Street, Los Angeles, Cal.
Approved October 6, 1913.

SIGNS, Electric.—Jewel Electric Sign Company, 160-164 East Eighth Street, Erie, Pa.
Approved October 10, 1913.

SWITCH BOXES.—National Metal Molding Company, Fulton Building, Pittsburgh, Pa.
"National" sherardized switch boxes, pressed steel, in single units for use with flexible tubing. These boxes have one removable side and suitable fastenings by means of which a gang box of any desirable number of units can be obtained; catalog Nos. 2080, 2081.
"National" cast-iron single box, catalog No. 387; with flush switch adapter of stamped steel, catalog No. 384.
Approved October 6, 1913.

SWITCHES, Knife.—The Trumbull Electric Manufacturing Company, Plainville, Conn.
Alternating-current motor - starting switches with extensions for N. E. C. standard cartridge-inclosed fuses.
Type "A," 250 volts, direct-current and alternating-current:
30 amperes, catalog Nos. 1300, 1305, 1310.
60 amperes, catalog Nos. 1301, 1306, 1311.
100 amperes, catalog Nos. 1303, 1308, 1313.
500 volts, alternating-current:
30 amperes, catalog Nos. 1320, 1325, 1330.
60 amperes, catalog Nos. 1321, 1326, 1331.
100 amperes, catalog Nos. 1323, 1328, 1333.
Type "C," 250 volts, direct-current and alternating-current.
30 amperes, catalog Nos. 1350, 1355, 1360.
60 amperes, catalog Nos. 1351, 1356, 1361.
100 amperes, catalog Nos. 1353, 1358, 1363.
500 volts, A. C.
30 amperes, catalog Nos. 1370, 1375, 1380.
60 amperes, catalog Nos. 1371, 1376, 1381.
100 amperes, catalog Nos. 1373, 1378, 1383.
Approved July 26, 1913.

SWITCHES, Oil-Break.—Allis-Chalmers Manufacturing Company (Works of the Bullock Electric Manufacturing Company), Norwood, O.
Oil Switches for alternating-current motors.
Type L, 10 amperes, 550 volts.
Standards for the construction and test of oil switches of both the manually operated or nonautomatic type and the automatically operated or circuit-breaker type are now under consideration.
Pending the establishment of such standards, the results of examination of construction details and reports of satisfactory performance in the field indicate that the 600-volt alternating-current oil switches and circuit-breakers made by this manufacturer are suitable for use.
Approved September 13, 1913.

SWITCHES, Pendent Snap.—Chapman & Walker, Limited, Submittors, 65-69 Victoria Street. Toronto, Canada. Manufactured for the above by the Sterling Telephone & Electric Company, 200 Upper Thames Road, London, England.
Approved September 23, 1913.

SWITCHES, Push-Button Flush.—Chapman & Walker, Limited, Submittors, 65-69 Victoria Street, Toronto, Canada. Manufactured for the above by Sterling Telephone & Electric Company, Limited, 200 Upper Thames Road, London, England.
The following switches are approved and labeled under conditions stated in card of previous issue.
Single-pole, 10 amperes, 125 volts, 5 amperes, 250 volts, catalog No. A-231.
Approved September 30, 1913.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

MEAD, NEB.—Bonds have been voted for a lighting plant. Address the city clerk.

EAST ALTON, ILL.—The Village Board has decided to install a number of new lights. Z.

PAOLA, KANS.—$35,000 in bonds has been voted to purchase the Peoples Electric plant here, and improve it.

MUSCATINE, IOWA.—J. B. Hill of Iowa City will submit estimates to the Conucil for a municipal light plant.

VIRGINIA, MINN.—The ornamental lighting system will be repaired. For information write Clerk Bickford.

CONRAD, MONT.—A movement has been started for street lighting. Write the village clerk for information.

BLAIR, NEB.—The Council plans to spend $35,000 in bonds for an electric light plant. Address the clerk.

EAU CLAIRE, WIS.—An agitation has been started for a "White Way" lighting system. J. C. Fennessy is city clerk. C.

GREENSBURG, KANS. — $30,000 will be expended to install an electric light plant here. Address the city clerk for information.

CORRECTIONVILLE, IOWA.—An electric light plant will be erected here. Write the president of the Council for information. C.

BOZEMAN, MONT.—A movement has started for a more modern street lighting system. Write the president of the Council. C.

CROSBY, MINN.—The Commercial Club contemplates the installation of a "White Way" and is advertising for bids on standards. C.

BREWSTER, MINN.—It was voted to install electric lighting. A transmission line will be built from Worthington to cost $5,000. C.

CLIMAX, GA.—$5,000 will be expended for the construction of an electric light plant here. Address the mayor for particulars.

LISBON, N. D.—Lisbon Electric & Power Company has been incorporated with a capital of $30,000 by Frank B. Thompson and others. C.

BAYONNE, N. J.—The Vacuum Oil Company will build an extension to its electrical plant. A building permit for the work has been issued. A.

HAMILTON, MO.—Miller & Gilber have submitted a proposition to the City Council to construct an electric light plant at this place.

CANTON, O.—The Knight Tire & Rubber Company plans the installation of electrical apparatus that will double the capacity of its power plant. R.

ISHPEMING, MICH.—The Marquette County Gas & Electric Company is figuring on extending its service to take in the Palmer district.

WINONA, MINN.—A movement has been started for an ornamental lighting system in the business district. George Hirsch is president of the company. C.

DRAKE, N. D.—George E. Todd, Minot, has been granted a franchise for an electric light plant here. He will erect a plant to cost $10,000.

LEITCHFIELD, KY.—The Leitchfield Electric Light, Heat & Power Company is planning to rebuild its plant, which was recently destroyed by fire.

GALESVILLE, WIS.—Next spring the local electric company will practically rebuild the wiring and change the street lighting in the residence district. C.

HILLSBORO, ILL.—The Southern Illinois Light & Power Company of this city has been awarded a two-year contract for lighting the village streets at Harvel. Z.

SWANTON, O.—The Swanton Light & Power Company has been incorporated with a capital stock of $10,000 by Abner D. Baker, Fred E. Pilliod and others.

NEW RICHMOND, IND.—The Montgomery Light & Power Company is planning to erect 20 miles of transmission line and distribution system in New Richmond.

CLEVELAND, O.—Mayor Baker advocates that all wires of all public service corporations be placed underground in all streets torn up for repairing in the spring.

LAGRANGE, IND.—The LaGrange County Light & Power Company has been incorporated with a capital stock of $75,000 by George P. Avis, Floyd D. Avis and others.

WILD ROSE, WIS.—Wild Rose Electric Light & Power Company, has been incorporated with a capital of $5,000. J. A. Peterson and F. V. Johnson are among the incorporators. C.

SEATTLE, WASH.—A bill is before the Council providing $100,000 for the immediate enlargement of the city lighting plant. Address the city engineer in regard to the matter.

FREEPORT, ILL.—The Freeport Railway & Light Company proposes to install a new magnetite arc lighting system in the streets when its present contract expires in two years. Z.

MAPLEWOOD, MO.—The Independent Light & Power Company has been granted a franchise to install electric lights in the city of Maplewood. Address J. M. Gore for particulars.

WINONA, MINN.—George Hirsh has been made chairman of a committee to look up cost and estimates and raise funds for a "White Way" lighting system on the business streets.

PEORIA, ILL.—Property owners on Hamilton Boulevard, headed by John E. King, have agreed to install ornamental lights from Monroe to North Street, if the city will supply power.

JOLIET, ILL.—Mayor Wood has decided to install electrical power for pumping at the city waterworks station as soon as finances will permit. The estimated cost of the change is $35,000.

WHITE, S. D.—Prominent farmers living in the region surrounding White have taken preliminary steps toward organizing an electric light company. Address R. H. Holden for information.

GREENWOOD, MINN. — Greenwood Electric Heat & Power Company has been incorporated. Oscar Claussen, city engineer, St. Paul, is president. The object is to sell steam and electricity. C.

ELKHART, TEX.—The Texas Power & Light Company is contemplating the construction of an electric light system in this place. Power will be transmitted from the company's plant at Palestine. D.

SAN ANDREAS, CAL.—Bids have been called for the installation of a lighting system for the Mokelumne Hill Lighting District of Calaveras County, and supplying of electric current for five years.

BROOKLINE, MASS.—The selectmen of the town of Brookline have granted permission to the Boston Edison Company to construct and maintain underground conduits in Kent street and Beech Road. W.

SHARON, PA.—The Street Lighting Committee has recommended to the Council that electricity replace gas now in use, and it is said the Council will act favorably. Fred Allen is chairman of the Committee. R.

KIRKLAND, ILL.—The Village Board has awarded a 10-year contract to the Illinois Northern Utilities Company to light the streets and to install a motor and furnish power for pumping at the water works station. Z.

SWANTON, O.—Swanton Lighting & Power Company has been chartered with a capitalization of $10,000. Abner D. Baker, Fred E. Pilliod, T. J. Pilliod, Robert S. Graves and A. A. Price are the incorporators. R.

CLATSOP, ORE.—The City Council recently granted a franchise to the Seaside Power & Light Company, to extend its light and power service into the city. The company will begin work of construction shortly. O.

McGREGOR, IOWA.—The McGregor Electric Light & Power Company has been granted a 25-year franchise, giving them the right to erect and maintain lines through town for the transmission of electricity.

GALESBURG, ILL.—The City Council has passed a resolution directing that an inquiry be made as to the cost of transforming the municipal electric light plant into one that can supply power for commercial use. Z.

MANSFIELD, O.—The Council has ordered Service Director Blecker to enter into contract with H. Whitford Jones Company, of Cleveland, consulting engineer, to lay out an entire new system of street lighting. R.

INTERCOURSE, PA.—The Intercourse Electric Light, Heat & Power Company is planning to erect a 2,300-volt transmission line for a distance of four miles. Address E. L. Zimmerman, secretary, for information.

TOTTENVILLE, N. Y.—The Richmond Light & Railroad Company will rebuild its electric power plant at Livingston, which was recently destroyed by a boiler explosion; in the new plant the former capacity will be doubled.

DULUTH, MINN.—Electrical Inspector J. W. Schneider has completed the survey of the electric street-lighting system and is now engaged in shaping his findings and recommendations for submission to the City Council.

PETERSBURG, ILL.—The Menard County Board of Commissioners and the City Council have decided to install 12 ornamental lamps about the Courthouse Square, the county paying for the installation and the city supplying the power. Z.

DES MOINES, IOWA.—On the suggestion of Mayor Hanna, the city council is investigating the advisability of establishing a municipal light plant at the market house, to supply the electric current for lighting the city buildings.

ST. JOSEPH, MO.—A plan for a "White Way" lighting system on Ashland Avenue, Frederick Boulevard to Lover's Lane, is under consideration by the Board of Public Works. Address Councilman C. D. Radford for desired information.

HILLSBORO, MO.—The Montesano County Club will erect clubhouse, the specifications including an electric-light plant large enough to furnish light to Kimmswick and Montesano. Address William H. O'Brien, president of the Club, for information.

SPRINGFIELD, ILL.—Petitions are being circulated asking that an ordinance be initiated providing for the expenditure of $20,000 for a generator at the municipal waterworks station to be used as the nucleus of an electric lighting plant which will sell power for commercial purposes. Z.

BREMERTON, WASH.—At a recent meeting of the City Council, W. D. Peters, a local attorney appearing for promoters, offered to build a light and power plant to cost $288,000, which would be turned over to the city at the end of two years. The names of the promotors have not been disclosed.

JERSEY CITY, N. J.—In connection with bids to be received by the Board of Education for the erection of new school No. 24 on Virginia Avenue, up to December 4, bids will be received for electrical work, and heating, and ventilating work at the same time. G. Fred Ege is secretary of the Board.

VISALIA, CAL.—The Mt. Whitney Power Company is planning to expend $1,600,000 for service extensions. Among the proposed improvements are a fifth power plant on the Kaweab River near Lemon Cove, reconstruction of the steam plant at Visalia and the extending of systems through Strathmore, Woodville and Porterville districts.

PORTLAND, ORE.—After a conference with the Reclamation Commission, Secretary of the Interior Lane has set aside from the reclamation fund $15,000 to be used jointly with an appropriation of a like amount made by the Oregon legislature to defray the cost of survey and examination of various water-power sites on the Columbia River.

ALEDO, ILL.—The City Council has appointed a committee to make an investigation with a view to the establishment of a municipal electric light plant, which in addition to lighting the city streets will supply power for sale, auxiliary power for pumping city water and steam for heating purposes. The committee is empowered to employ consulting engineers or other specialists. Z.

PATERSON, N. J.—The Society for the Establishment of Useful Manufactures, now building a large hydroelectric power plant at the Passaic Falls, will build an auxiliary steam power station in connection, to be used during low-water periods at the Falls. The proposed steam plant is estimated to cost about $500,000. John W. Cooke, Passaic, N. J., is hydraulic engineer for the society. A.

VENICE, ILL.—One of the immediate effects of the merger of the Illinois Traction lines with the Western Railways & Light Company included in the list of subsidiaries of the Illinois Traction system will be the expenditure of about $75,000 in improving the electric plant at Venice. The greater part of the expenditure will be for the installation of an additional water pumping plant.

GALVA, ILL.—E. L. Brown and Edwin Brown of Elmwood have entered the field of competition in electricity served for Henry and Knox Counties. Within ten months it is expected that a 900-horsepower plant will be completed in Galva, which will be able to supply electricity for light and power to Galva, Kewanee, Cambridge, Altoona, Onsida, Lafayette and other nearby towns and farmers along the route of the conduits.

PILOT MOUND, IOWA.—The Central Iowa Power Company will build a line from this city to Wolf to join the present line of that company. The new line is to supply Pilot Mound with street lighting and domestic lighting and power circuits. The transmission will be three-phase, three-wire, 2,200-volts. Distribution will be on a three-wire 220-volt circuit. Contract for this work will be let on November 25. For further particulars apply to W. H. Grover, Ames, Iowa.

JACKSONVILLE, ILL.—A report has been submitted to the Public Affairs Committee of the Chamber of Commerce by W. B. Miser of two plans for lighting the streets of the city, including a municipal plant. One plan calls for 180 450-watt arcs, 184 100-candlepower Mazdas and 544 60-candlepower Mazdas. The other calls for 664 100-candlepower Mazdas and 136 60-candlepower Mazdas. Prof. J. M. Bryant of the University of Illinois has reported that the present municipal lighting equipment has little value and that about $200,000 will be required for a municipal plant to light the streets and to sell power for commercial purposes, or $60,000 for one to merely light the streets. Z.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

HECKER, ILL.—The Hecker Telephone Association will build a new line to Red Bud. Z.

SHICTON, WIS.—The telephone exchange will be enlarged and rebuilt and the new wire will be galvanized steel. C.

BATESVILLE, ARK.—The Southwestern Telephone & Telegraph Company will expend $24,000 to improve its telephone system here.

PRESCOTT, IOWA.—The Prescott Mutual Telephone Company has been incorporated with a capital of $9,900. W. D. James is president.

OGALLAH, KANS.—The Ogallah Telephone Company has been incorporated with a capital stock of $2,500 by W. A. Tawney, W. D. Caskey and others.

FISHER, ILL.—Fisher Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are Dan Zehr, O. C. Giertz and I. J. Knapp.

SANTA PAULA, CAL.—The Limoneria Company has contracted with the Dean Electric Company for the installation of 16 miles of private telephone wires on its lemon ranch.

STURGEON BAY, WIS.—Sevastapol Farmers' Telephone Company has been incorporated with a capital stock of $3,000 by John G. Walker, L. F. Henschel and Joseph Petersilka.

RICHARDSON, KY.—The Richardson & Georges Creek Telephone Company has been incorporated with a capital stock of $1,500 by Franklin Chandler, Rob Hatfield and others.

LOS ANGELES, CAL.—Articles of incorporation have been filed here for the San Joaquin Valley Telephone Company with a capital stock of $10,000 by F. H. Edwards, J. M. O'Brien and L. Spalding.

OKLAHOMA CITY, OKLA.—Line No. 1 of the Avard Telephone System has been incorporated with a capitalization of $240. The incorporators are John Miller, J. W. Smoot, of Avard; Charles Bixler, of Waynoka.

RIVERSIDE, WASH.—The Riverside Telephone Company has been incorporated with a capitalization of $1,000 by A. W. Campbell, C. E. Blackwell, Hugh Miller, G. K. Cooper, H. M. Fryer, R. L. Grounds and W. K. Halsey.

VISALIA, CAL.—The work of extending the telephone service in Visalia will be started as soon as improvements at Porterville are completed. The sum of $8,000 will be expended in this vicinity. Address the city clerk for particulars.

HADDONFIELD, N. J.—The Delaware & Atlantic Telegraph & Telephone Company is planning for the installation of new underground conduit lines in sections of Redman Avenue, Mt. Vernon Avenue, Walnut Street and Ellis Street. Permission for the work has been requested from the Borough Council. A.

PORT ARTHUR, TEX.—It is announced by P. K. Higgins, of Waco, general manager of the South Texas Telephone Company, that extensive improvements are to be made on the company's exchange here. A new office building is to be erected and the switchboard increased.

ELECTRIC RAILWAYS.

(Special Correspondence.)

OGDEN, UTAH.—The Ogden Rapid Transit Company plans to extend its lines. Address the secretary.

TAMPA, FLA.—The Tampa Electric Company will extend its line for a mile on Grand Central Avenue. Address J. C. Woodsome, manager.

LA CROSSE, WIS.—The Wisconsin Railway Light & Power Company, C. C. Smith, Milwaukee, president, is planning an interurban line to Black River Falls and other extensions.

CEDAR RAPIDS, IOWA.—The Commercial Club has raised $200,000 for construction of the Cass interurban road from here to Waterloo and work will begin at once. W. G. Haskell is interested. C.

CENTRALIA, ILL.—The City Council has granted a 20-year franchise to the Centralia & Central City Traction Company to construct and operate an electric railway in the city. The proposed line will be extended to Sandoval. Z.

SEWAREN, N. J.—The Public Service Railway Company has acquired right-of-way for its proposed short line between this place and Port Reading by condemnation proceedings, and will immediately resume construction work. A.

PORTLAND, ORE.—Plans for the installation of an alternating-current block system on the Oregon Electric tracks were recently submitted to the State Railroad Commission. The system will be installed and ready for use January 1st. O.

TEMPLE, TEX.—The project to build an interurban electric line between Temple and Marlin has been revived. A new survey is being made between the cities by County Engineer S. D. Hanna. Nothern capital is said to be interested. D.

EDWARDSVILLE, ILL. — The Madison County Board of Supervisors has granted a franchise to the Alton & Eastern Railway Company to build a street railway from College Avenue in Alton to the site of the new Illinois State Hospital for Insane. Z.

VANCOUVER, WASH. — The Northwestern Electric Company recently filed mortgages to the extent of $10,000,000, substantiating, in a way, the announcement that an electric railway will be built from Portland to the north fork of the Lewis River *via* this city. O.

BUTTE, MONT.—Actual construction work in the proposed electrification of the Pacific Coast extension of the Milwaukee road will start December 1 on the Bitter Root division in this state, from Harlowton, Mont., to Avery, Idaho, 450 miles. Copper requirements for wiring alone will approach 60,000,000 pounds. C.

OZARK, MO.—The Ozark Commercial Club is seeking to get in touch with capitalists to build an electric line from Springfield *via* Ozark to Lake Taneycomo, in Taney County. Electric power is available in transmission lines of the Ozark Power & Water Company from its big dam on White River.

POCATELLO, IDAHO. — Capital for the construction of a street railway system here to operate on the principal streets of Pocatello, and to extend to St. Paul, has been secured in Salt Lake City, according to J. D. Browning, a local promotor. The line will be 15 miles in length, and construction will begin as soon as orders can be placed for materials. O.

EAU CLAIRE, WIS.—Milwaukee Western Electric Railway Company contemplates building to Eau Claire, Menomonie and St. Paul. The present route as laid out extends from Milwaukee to Green Lake with two branches, or a total of 108 miles. The company will build first from Milwaukee to Fox Lake, and the branch from Sussex to Pewaukee and Waukesha. Carl Meiter represents the company. C.

MADISONVILLE, KY.—The Hopkins County Fiscal Court has granted the right of way for the Madisonville & Nortonville Light, Power & Traction Company to build an electric line between this place and Nortonville. The road when built will leave Madison, run through Earington, Barnsley, Morton's Gap and Oak Hill to Nortonville. The right of way had been secured from the farmers between Madisonville and Nortonville.

PROPOSALS.

BOILER FEED PUMPS.—Sealed proposals will be received at the office of the Director of Public Service, 204 City Hall, Cleveland, O., for boiler feed pumps for the municipal electric light plant. Address W. J. Springborn, Director Public Service.

STORAGE BATTERIES AND CHARGING PANEL.—Sealed proposals will be received at the office of the Light House Inspector, Baltimore, Md., until December 1 for furnishing storage batteries and charging panel. Blank proposals and particulars may be obtained by addressing the Inspector.

ELECTRIC-LIGHTING SYSTEM AND FIXTURES.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until December 2 for furnishing 18 electric-light fixtures, to be delivered at the hospital, Washington, D. C., as per Schedule 6,020; and until December 9 for installing an electric-lighting system at the Navy Yard, Newport, R. I., as per Schedule 6,030.

RAPID TRANSIT SUBWAYS.—Bids will be received on January 5, 1914, at the office of the Harbor and Subway Commission, 130 North Clark Street, Chicago, Ill., for the construction, equipment, maintenance and operation of a comprehensive system of rapid-transit subways for passenger transportation in the city of Chicago. Address Eugene Block, Chairman, Committee on Local Transportation of the City of Chicago.

ELECTRIC CONDUITS AND WIRING AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received by the Supervising Architect, Washington, D. C., until December 1 for furnishing electric conduit and wiring and interior lighting fixtures for the post office at Dubuque, Iowa; and until January 2, 1914, for furnishing the same for the post office at Brigham City, Utah. Drawings and specifications may be obtained from the office of the Supervising Architect or from the custodians of the sites named.

NEW INCORPORATIONS.

CHICAGO, ILL.—The Universal Utilities Company of Illinois has been incorporated with a capital stock from $50,000 to $500,000.

LOUISVILLE, KY.—The Walker Lilly Electric Company has been incorporated with a capital stock of $600 by E. D. Lilly, Julia H. Lilly and Irving Walker.

PAUL, IDAHO.—The Paul Electric Company, Limited, recently filed articles of incorporation, naming M. E. Watson, C. A. Burke, et al., as incorporators. The capitalization is $10,000.

HOBOKEN, N, J.—The Freeport Tungsten Lamp Company has been incorporated with a capital of $100,000 to manufacture tungsten lamps. H. A. Jaeger, Robert H. Herschman and Guy V. Williams are the incorporators.

CHICAGO, ILL.—The Nonpareil Lock Company has been incorporated with a capital stock of $40,000 to manufacture locks, hardware and electrical specialties. The incorporators are Matthew Borwick, C. F. Dusman and A. B. Cameron. Z.

BROOKLYN, N. Y.—Ollendorf Gas & Electric Fixture Company, Incorporated, has been granted articles of incorporation, capitalized at $500. The incorporators are David M. Ollendorf, Annie Ollendorf and Jeanette Ollendorf, all of this city.

ASHTON, IOWA.—The Carmichael & King Company has been incorporated with a capitalization of $15,000 to engage in the telephone and electrical equipment business. C. J. King, is president; J. H. Carmichael, secretary-treasurer of the company.

NEW YORK, N. Y.—A. L. Weiss, Incorporated, has been incorporated with a capital stock of $10,000 to deal in hardware, gas and electric fixtures, etc. The incorporators are Matilda Lanosman, Adolph L. Weiss and Jennie Weiss, all of New York City.

AMERICUS, GA. — The Public Utilities Company has been incorporated with a capital stock of $300,000 to operate gas, electric light and power plant here. The incorporators are Louis F. Doyle, William C. Potter and Thomas J. Brown of New York.

CHICAGO, ILL.—The Automatic Display Company has been incorporated with a capital stock of $100,000 to manufacture and sell mechanical and electrical machines, etc. The incorporators are Charles R. Casler, George M. Bagly and Irma Labes.

CHICAGO, ILL.—National Gasoline Lighting Company has been incorporated for the purpose of manufacturing gasoline and electric lamps. The capital stock of the company is $30,000 and the incorporators are L. R. Bissell, D. M. Bissell and J. F. Lawrence.

PITTSBURGH, PA.—Schutte Electric Company has been incorporated to deal in electrical appliances. The capital stock of the company is $50,000 and the incorporators are Herman Schutte, Wilkinsburg; G. L. Kopp, Jacob C. Platz, T. R. Evans and Louis N. Shuman, Pittsburgh.

HORNELL, N. Y.—Alliance Electric Company, Incorporated, has been granted articles of incorporation to engage in electrical contracting. The capital stock is $10,000 and the incorporators are Charles F. Kistinger, New Rochelle; Stephen C. Reville, New York City; and A. W. Dalton, Glen Cobe.

FINANCIAL NOTES.

The Public Utilities Commission has authorized the Halifax Tramways Company to issue 6,000 shares of ordinary stock at par. The additional capital is to be devoted to extensions and the retirement of certain bonds.

At the annual meeting of the Third Avenue Railway, New York, retiring directors were re-elected, and the consolidation of the Kingsbridge Railroad with the Third Avenue System was formally ratified.

The upstate New York Public Service Commission has authorized the Hornell Electric Company to execute a mortgage to the Colonial Trust Company to secure $400,000 first and refunding five-per-cent bonds. Of these bonds $150,000 are to be issued, of which $85,000 are to be exchanged par for par for the first-mortgage bonds of the company and $65,000 are to be sold at not less than 85 per cent of par, to discharge current liabilities.

The Willapa Electric Company, which was organized by New York interests in August, 1913, to take over street railways, electric light and power properties in Raymond and South Bend, Wash., has sold $310,000 of first-mortgage 10-year six-per-cent bonds for extensions and improvements. The authorized issue of these bonds is $1,500,000 and others may be issued from time to time as required for 80 per cent of cost of improvements.

An announcement has been made by President Hays, of the Mount Whitney Power & Electric Company, that the company will expend $1,600,000 within the next fourteen months on improvements and extensions of the service. The work on the Wolverton dam, located back of the giant forest and power plant No. 5, will be rushed to completion and extensive improvements will also be made at the Visalia steam generating plant. New substations of a modern type are to be put in at Woodville, Terra Bella, Goshen, Strathmore and Elimart, and the stations at Delano and Exeter will be increased in size.

Arrangements have been completed for the refinancing of the Nevada-California Power Company and its consolidation with the Southern Sierras Power Company. All the stock of the Southern Sierras is held by the Nevada-California Power Company, which is controlled by Denver men. The new company will have $5,000,000 of stock and an authorized bond issue of sufficient size to care for extensions for a number of years. It will be placed on a dividend basis at once. The plants of the Nevada-California Power Company are at Bishop Creek, Cal., from which point it supplies current to territory in northern California and Nevada. The Southern Sierras Company serves territory in the southern part of California.

Operating control of the American Cities Company, and its subsidiaries, will, after December 1, be in the hands of the United Gas & Electric Corporation. Ford, Bacon & Davis, the present operators of the American Company, have disposed of their holdings and will terminate their management on December 1. Ford, Bacon & Davis are interested in the United Gas & Electric Corporation.

Directors of the Washington Water Power Company have authorized an increase in the company's capital stock from $15,000,000 to $20,000,000 and are sending circulars to the stockholders announcing a special meeting to be held in Spokane, Wash., on December 2, when stockholders will be asked to ratify the increase. A two-thirds vote of the stock represented is required in order to authorize the increase. Only a part of the new stock, if authorized, will be issued for the present. It will be offered at par to stockholders, who will have the right to subscribe to 10 per cent of their holdings. Present market price of the stock is about 120. The company is constructing a large dam and power house and it is at a reported cost of more than $3,000,000. It is understood that part of the money received from the sale of the new stock will be used to pay off loans made to finance the construction work.

Dividends.

American Railways Company; regular quarterly of 1.5 per cent on the common stock, payable December 15 to stock of record November 29.

Atlantic Gas & Electric Company; quarterly 1.5 per cent, payable November 15.

Citizens Traction Company; the regular semi-annual dividend of $1.50 a share, payable November 17.

Columbus Railway Company; regular quarterly of 1.25 per cent on the common stock, payable December 1.

General Electric Company; quarterly of $2, payable January 15 to stock of record November 29.

Middle West Utilities Company; regular quarterly of $1.50 on preferred, payable December 1 to stock of record November 15.

Northern Texas Electric Company; regular quarterly of $1.75 a share on common, payable December 1 to stock of record November 19.

Philadelphia Company; semi-annual of three per cent for guaranteed mortgages, payable December 10 to stock of record November 29.

Philadelphia Electric Company; regular quarterly of 1.75 per cent, payable December 15 to stock of record November 20.

Southwestern Utilities Corporation has declared a regular semi-annual dividend of 1.5 per cent, payable December 1 to stock of record November 20.

Tennessee Railway, Light & Power Company; regular quarterly of 1.5 per cent on its stock, payable December 1 to stock of record November 15.

Washington Railway & Electric; regular quarterly dividends of 1.5 per cent on common and 1.25 per cent on preferred stocks, payable December 1.

West Kootenay Power & Light Company; quarterly of 1.25 per cent on the common stock, payable December 1.

The J. G. White Engineering Corporation; regular quarterly 1.75 per cent on preferred, payable December 1 to stock of record November 20.

J. G. White Management Corporation: regular quarterly of 1.75 per cent on preferred, payable December 1 to stock of record November 20.

Reports of Earnings.

METROPOLITAN WEST SIDE ELEVATED.

The Metropolitan West Side Elevated Railroad Company reports for the year ended June 30, 1913, compares as follows:

	1913	1912
Gross	$2,954,451	$2,991,180
Expenses	1,426,761	1,396,981
Net	1,527,690	1,594,199

The deficit for the year ended June 30, 1913, after deducting charges, depreciation, dividends, etc., was $104,331 as compared with a surplus of $118,292 the previous year.

EASTERN PENNSYLVANIA RAILWAYS.

	1913	1912
September gross	$ 66,924	$ 66,912
Net after taxes	26,655	26,828
Surplus after charges	8,115	8,972
Twelve months' gross	792,596	698,192
Net after taxes	337,799	226,329
Surplus after charges	120,428	53,882

PORTLAND RAILWAY, LIGHT & POWER.

Portland Railway, Light & Power Company for September and twelve months ended Sept. 30 reports earnings as follows:

	1913	1912
September gross	$ 547,451	$ 542,387
Net after taxes	268,950	269,565
Surplus after charges	92,032	121,245
Twelve months' gross	6,689,055	6,557,842
Net after taxes	3,366,863	3,308,096
*Surplus after charges	1,431,971	1,608,828

*Equivalent to 5.7 per cent on $25,000,000 capital stock.

EAST ST. LOUIS & SUBURBAN.

	1913	1912
September gross	$ 238,547	$ 217,962
Net after taxes	97,118	101,069
Surplus after charges	47,370	52,513
Twelve months' gross	2,646,837	2,374,432
Net after taxes	1,135,468	1,061,935
Surplus after charges	547,730	491,168
*Balance after preferred dividends	197,730	141,168

*Equivalent to 2.8 per cent on the common stock.

PACIFIC LIGHT & POWER.

	1913	1912
September gross	$ 257,901	$ 215,820
Net after taxes	100,763	95,131
Surplus after charges	59,880	56,989
12 months' gross	2,814,813	2,440,860
Net after taxes	1,250,683	1,064,316
Surplus after charges	778,081	568,062

UTAH POWER & LIGHT COMPANY.

	1913	1912
October gross	$ 158,055	$ 108,364
Net	94,063	54,877
Six months' gross	876,325	719,657
Net	533,396	371,538
Twelve months' gross	1,664,216	1,484,789
Net	977,015	810,111

ONTARIO POWER.

The Ontario Power Company, of Niagara Falls, reports to the New York Stock Exchange for the eight months to August 31, 1913, as follows:

Gross	$982,681
Net earnings, after taxes	808,419
Other receipts	129,465
Total income	937,885
Surplus, after charges	368,367

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Nov. 17.	Nov. 10.
American Tel. & Tel. (New York)	119⅜	119½
Commonwealth Edison (Chicago)	133	139
Edison Electric Illuminating (Boston)	257½	264½
Electric Storage Battery, common (Philadelphia)	46	45½
Electric Storage Battery, preferred (Philadelphia)	46	45½
General Electric (New York)	139	139¼
Kings County Electric (New York)	119	119
Manhattan Transit (New York)	1⅛	1
Massachusetts Electric, common (Boston)	11	11
Massachusetts Electric, preferred stamped (Boston)	65	67
National Carbon, common (Chicago)	135	133
National Carbon, preferred (Chicago)	112	114
New England Telephone (Boston)	135	139
Philadelphia Electric (Philadelphia)	22⅜	22⅜
Postal Telegraph and Cables, common (New York)	77	77
Postal Telegraph and Cables, preferred (New York)	63	63
Western Union (New York)	62¼	61
Westinghouse, common (New York)	65	65
Westinghouse, preferred (New York)	109	110

PERSONAL MENTION.

MR. J. K. L. ROSS, of Montreal, has been elected a director of the Canadian General Electric Company, succeeding his father, the late James Ross.

PROF. A. H. FOREMAN has been appointed assistant professor of electrical and experimental engineering in West Virginia University.

MRS. PRESTON S. MILLAR will speak upon "The Illumination of the Home" at the regular monthly meeting of the Froebel Society at Pratt Institute, Brooklyn, N. Y., on November 25.

MR. C. V. WOOD has assumed the office of vice-president in charge of the operating and traffic departments of the Worcester Consolidated Street Railway and allied roads in central Massachusetts.

MR. R. E. BRIAN, manager of the Federal Sign System, Electric, in Louisville, Ky., has been elected to membership in the Louisville Rotary Club. This organization is unique in that it admits but one member from any line of business.

MR. C. C. HILLIS, treasurer and general manager of the Electric Appliance Company of San Francisco, is making an eastern trip and was in attendance at the Electrical Supply Jobbers' meeting at Hot Springs, Va., November 18, 19 and 20.

MR. J. H. W. REES, formerly manager of the advertising and publicity department of the Metropolitan Telephone & Telegraph Company of New York, has accepted a position as sales and advertising manager of Deuth & Company, manufacturers and importers of "Deco" drawn-wire tungsten lamps. Mr. Rees is executive advertising manager of the National Progressive Party, a member of the New York Ad. Men's League, and an officer of the Associated Advertising Clubs of America.

MR. HERBERT L. HARRIES, assistant general manager of the Louisville Gas & Electric Company, has resigned in order to take a position with another Byllesby property, the nature of which will be announced shortly. Mr. Harries is receiving a promotion through the change. He has been assistant general manager of the company since the merger of the gas and electric companies of Louisville. He is a son of Gen. George H. Harries, president of the Louisville Gas & Electric Company.

MESSRS. E. ODIER and F. DOMINICE, of Geneva, officers of prominent financial institutions of Switzerland and France, have recently completed a survey of the public utility properties of H. M. Byllesby & Company, in which the interests they represent have considerable investments. At a luncheon given by Mr. Byllesby in their honor at the Union League Club, Chicago, they expressed themselves as pleased with the results of their inquiry and very favorably impressed with the organization's personnel and methods.

MR. H. M. BYLLESBY, president of H. M. Byllesby & Company, has recently returned from a brief visit to England. Discussing the business conditions, Mr. Byllesby, while deploring the present financial depression, stated that in his opinion normal prosperity and easy monetary conditions would again prevail within a reasonable period. He voiced a feeling of confidence in the ultimate fair treatment of service corporations throughout the United States by the various regulatory commissions having jurisdiction over them.

MR. LEROY J. HANNAH, head of the new-business department of the Louisville (Ky.) Gas & Electric Company, has resigned, effective November 15, to enter the service of Paul Jones & Company, Louisville distillers. Mr. Hannah was with the Kentucky Electric Company as head of the new-business department prior to the consolidation of that company with the Louisville Lighting Company, and was then given a similar position with Louisville Gas & Electric. Mr. E. L. Callahan, head of the new-business department of H. M. Byllesby & Company, has been handling that phase of the work for the Louisville Gas & Electric Company recently, though it is stated that his location at Louisville is temporary. Mr. Hannah will be associated with Mr. Robert Hughes, former president of the Kentucky Electric Company, in the Jones mail-order department.

MR. WILLARD L. CANDEE, president of the Okonite Company, New York, was tendered a dinner and presented with a silver loving cup by the Board of Directors of his company, Thursday evening, November 13. Captain Candee

Willard L. Candee.

sailed on Saturday, November 15, for a three months' tour, visiting the rubber plantation of his company at British Guiana and extending his trip to include England and the Continent of Europe, and was accompanied by Mrs. Candee. The dinner was in the nature of *bon voyage*, and was enjoyed by 21 persons, including the officials and staff of the Okonite Company and a few personal friends. The loving cup was of very handsome design from the famed Tiffany jewelry house, and bore an appropriate inscription. The dinner, which was a notable one in respect to viands and vintages, was served with an electrically worded menu at the Lotus Club, New York, and was participated in by the following gentlemen: Capt. Willard L. Candee, H. Durant Cheever, George T. Manson, W. H. Hodgins, W. C. Candee, R. Mace, J. D. Underhill, J. D. Ashton, F. J. White, W. M. Candee, C. A. Miller, W. G. Hovey, L. G. Martin, W. S. Brumley, C. N. Trump, F. D. Lawrence, Charles B. Price, W. F. Gaston, A. F. Townsend, Charles W. Price, and Col. Ezra De Forest.

MR. H. E. GIFFORD, JR., was appointed sales manager for the National Electric Specialty Company, Toledo, O., November 1, with headquarters in Chicago. He resigned as western representative of the L. S. Brach Supply Company to accept this position. Mr. Gifford has been in the signal business since 1905, when he went to work for the New York Central at Mott Haven, N. Y., as accountant in the office from which the electric zone work was handled. He was appointed chief clerk to Mr. Azel Ames, then signal engineer of the New York Central electric zone, in May, 1906. When the organization was disbanded in the latter part of 1907 he went into the accounting department of the Union Switch & Signal Company's Pennsylvania Terminal construction organization. In 1910 he entered the employ of the American Conduit Company, and was later connected with the installation of the underground conduit system of the New York, Westchester & Boston. He was appointed western representative for the L. S. Brach Supply Company in January, 1912.

MR. PHILIP S. DODD has allied himself with the Tucker Agency, Incorporated, at New York City. The Tucker Agency, headed by W. Gaylord Tucker, Jr., is well known in the advertising field and especially in electrical circles as advertising agents for the New York Edison Company, New York Electric Vehicle Association, United Electric Light & Power Company, and a number of other large interests in the electrical and mechanical fields. Mr. Dodd has been well known in the electrical industry for 12 years as manager of the ELECTRICAL REVIEW, director of publicity of the National Electric Lamp Association, past secretary of the Commercial Section of the National Electric Light Association, one of the organizers and recently secretary-treasurer of the Society for Electrical Development, Incorporated. A part of Mr. Dodd's work with the Tucker Agency will be the organization of a special department for central-station advertising service. The company has already prepared three series of advertising campaigns, any one of which can be efficiently used by either the large or small central station for both newspaper and direct advertising of a special character. Mr. Dodd has had a wide experience, as outlined above, in electrical publicity, and should prove a tower of strength to an already strong and well equipped organization.

OBITUARY.

MR. CHARLES D. ROBBINS, president of the Robbins Electric Company, of Pittsburgh, Pa., died at his home on November 12. Mr. Robbins went to Pittsburgh from Philadelphia about 20 years ago and after entering the oil business, which at that time was at its height, founded the electric company that bears his name. He was 79 years of age at the time of his death and is survived by a son, Mr. Harris Robbins, of Pittsburgh, and a sister.

NEW PUBLICATIONS.

NEW JERSEY COMMISSION REPORT.—The first volume of reports of the Board of Public Utility Commissioners of the State of New Jersey covering the period from May 1, 1911 to June 2, 1913, has been published in bound form. It contains the decisions of the Board in the cases which have come before it. An index of these cases is given and also an index of legal cases cited in the opinions.

NATIONAL ELECTRIC LIGHT ASSOCIATION.—The proceedings of the thirty-sixth annual convention of the National Electric Light Association, held at Chicago, in June, have been published in bound form. They comprise four volumes, one of which deals with general papers, reports and discussions; a second with the commercial sessions; a third with the accounting sessions and a fourth with the technical and hydroelectric sessions.

THE ENGINEERING CONTRACTOR.—The American Society of Engineering Contractors has begun the publication of a journal entitled *The Engineering Contractor*. This will appear monthly. The first number is dated October and comprises 20 reading pages, 9 by 12 inches in size, in addition to advertising. The publication is edited by the secretary of the Society, acting for the Committee on Publications. The business manager of the new journal is R. M. Hooker, 168 Duane Street, New York City.

FOREIGN TRADE OPPORTUNITIES.

(Where addresses are omitted they may be obtained from the Bureau of Foreign and Domestic Commerce, Washington D. C. In applying for addresses refer to file number.)

NO. 12,000.—ARC LAMPS.—An American consul in Canada reports that a committee from a local city council recently visited certain cities in the United States to inquire into the lighting system of the business sections. As a result of this trip the city will install 96 magnetite or luminous arc lamps. Plans and specifications may be obtained by applying to the superintendent of the electric light plant, whose name can be had by applying to the Bureau of Foreign and Domestic Commerce.

NO. 12,014.—MACHINERY AND ACCESSORIES.—A firm of commission agents in southern Europe informs an American consulate that it would like to get in touch with American manufacturers of machinery and accessories of all classes. Correspondence should be in Italian. References are furnished.

DATES AHEAD.

Meeting of Electric Sign Manufacturers to organize an association. La Salle Hotel, Chicago, Ill., December 1.

American Society of Refrigeration Engineers. Annual meeting, New York, N. Y., December 1-2.

American Automobile Association. Richmond, Va., December 1-3.

American Institute of Architects. Forty-seventh annual convention, New Orleans, La., December 2-4.

American Society of Mechanical Engineers. Annual meeting, New York, N. Y., December 2-5.

National Gas Engine Association, Toledo, O., December 4-6.

American Institute of Chemical Engineers, New York, N. Y., December 10-13.

American Association for the Advancement of Science. Annual meeting, Atlanta, Ga., December 29-January 3, 1914.

Western Association of Electrical Inspectors. Annual meeting, Cincinnati, O., January 27, 1914.

With the Electrical Manufacturers

Duplex Metals Company, Chester, Pa., has prepared a comically illustrated leaflet pointing out the advantages of copper-clad wire for telephone lines on board ship.

The Multi Refillable Fuse Company, Chicago, Ill, announces that Frederick Rall, 19 Park Place, New York City, has been appointed as its New York representative.

Wagner Electric Manufacturing Company, St. Louis, Mo., announces that it has made arrangements with E. I. Van Doren, 343 River Street, Troy, N. Y., to handle the sale of the various Wagner products in Troy and vicinity.

Hess-Bright Manufacturing Company, Philadelphia, Pa., has issued a booklet dealing with ball bearings for axle lighting generators. This discusses the subject in general and shows the peculiar advantages of Hess-Bright bearings for this purpose. A number of illustrations show their application.

Electric Machinery Company, Minneapolis, Minn., has issued a number of new illustrated inserts to its folder of electric products. One of these relates to vertical-type alternators; others to induction motors, synchronous motors, direct-current generators and motors, belted and engine-type alternators.

Minneapolis Steel & Machinery Company, Minneapolis, Minn., has issued a 48-page booklet entitled "What We Do." This publication contains over 75 illustrations of various products manufactured by the company, and of typical installations in which these products are used. Among the great variety are structural steel, steel bridges, sheet-metal products of various kinds, Corliss steam engines, Muenzel gas engines and producers, Twin City oil engines, hoists, derricks, tractors, etc.

Wagner Electric Manufacturing Company, St. Louis, Mo., has published an artistic 16-page booklet devoted to the pioneers who have made the present age of electricity possible. The colored cover is suggestive of the severe trials of pioneers in a primeval field. Portraits and brief comments on the work of Franklin, Volta, Ampere, Ohm, Kelvin and Edison are included, as also references to some lines of electrical apparatus in the development of which the Wagner Company was pioneer.

Franks Manufacturing Company, Rock Island, Ill., maker of the well known Franks portable lighting fixtures, announces that it has secured the services of J. G. Pomeroy to represent the company on the Coast. The company also announces that A. A. Wisersky, formerly with the Central Electric Company, will represent it in Chicago. Headquarters will be at 516 West Monroe Street. Mr. Wisersky will also represent the Trio Manufacturing Company, of Rock Island, which makes switches and panelboards.

Crocker-Wheeler Company, Ampere, N. J., has issued bulletin No. 160, devoted to form Q induction motors. These machines are either two-phase or three-phase, 60-cycle motors for general use. Both squirrel-cage and slip-ring motors are made. The bulletin describes their construction and advantages in a unique manner, making it possible both for the layman and the technically trained man to understand all about these machines. A number of interesting line drawings are used throughout the bulletin.

Victor Animatograph Company, Davenport, Iowa, has called attention to the merits of the Victor stereopticon. This device is a compact instrument that can be readily carried about from place to place in its case as easily as an ordinary traveling grip. It contains an electric arc lamp which is said to be the only successful one that may be attached to any incandescent lamp socket or ordinary lighting circuit. A catalog describing these stereopticons has been prepared by the company and will be sent to anyone interested in this subject.

Chicago Fuse Manufacturing Company, 1014 West Congress Street, Chicago, Ill., is sending out circulars to the electrical trade calling attention to some of its special conduit fittings for use in reinforced-concrete buildings. Among these fittings is a new extension ring of unique construction and readily adaptable to this work. Several conduit boxes, designed particularly for concrete buildings, are also described and illustrated. Among these is the No. 104-OD box and the No. 180 box, also the well known sectional switch boxes made by this company.

Badt-Westburg Electric Company announces removal of its offices from Suite 1504 to Suite 832 Manadnock Block, Chicago, where it will have enlarged quarters better adapted to the conduct of its steadily increasing business. This company is and has been for many years the western representative of the Weston Electrical Instrument Company, of Newark, N. J., and of the Ward Leonard Electric Company, of Bronxville, N. Y. Paul A. Westburg, president, says that he will be glad to have any of his many friends call at the new quarters where they will be given a cordial welcome.

Automatic Electric Company, Chicago, Ill., has recently issued two bulletins through its engineering department. One of these contains an interesting discussion on the maintenance of lead-covered telephone cables. This gives an account of the chief troubles encountered and rules for cable-repair men, also many data, diagrams of tests and repair methods, etc. The other bulletin contains notes on the prevention of electrolytic corrosion of lead-covered telephone cable. This bulletin contains methods for conducting electrolysis surveys, methods for insulating cable sheathing, etc. Both of these bulletins were compiled by Bernard C. Groh.

John A. Roebling's Sons Company, Trenton, N. J., has published in large bulletin form, extracts from an article that will appear shortly in the "History of the Panama Canal, Its Construction and Builders." This particular bulletin is entitled "The Wire Rope at Panama," and contains some exceptionally fine views of the construction work in various parts of the canal. These views illustrate and the bulletin text describes typical cases in which Roebling wire rope was extensively used. One of these ropes had an external diameter of 3.25 inches. It consisted of six strands, each of 37 wires, twisted around an independent rope of 6 strands, each of 19 wires, which in turn is twisted around a blue hemp center.

General Insulate Company, 1008 Atlantic Avenue, Brooklyn, N. Y., the well known manufacturer of "Insulate" and other composition goods, has recently developed a new telephone receiver shell which has appropriately been named "Unbreakable." This is a composition shell without lining or reinforcement. It is much stronger than the best grade of hard-rubber or metal-lined shells. It has a mirror-like finish, which does not wear off and is not affected by moisture, oil, acid, heat or cold. A similar composition is also being used in the manufacture of telephone mouthpieces. The company is rapidly increasing its manufacturing facilities to take care of anticipated heavy demands for these Unbreakable shells and mouthpieces.

Edison Storage Battery Company, Orange, N. J., has practically completed its large new factory building which awaits merely the installation of machinery to begin making the Edison battery on a greatly enlarged scale made necessary by the rapidly increasing demand for this type of storage battery for electric pleasure and commercial cars, street railway cars, train lighting and other purposes. A rumor now prevalent that a new type of Edison battery was forthcoming and that the manufacture of the present type of cells would be curtailed until its development, has been flatly denied by the company. The Edison battery is now practically the same as when Mr. Edison perfected it a few years ago. The present type of battery is not likely to be changed. In the latter part of December it is expected that all the new machinery in the new factory will have been installed and the present machinery rearranged to more efficient positions. It is believed that 2,000 additional employees will be required when the enlarged plant is put into full operation.

Record of Electrical Patents.

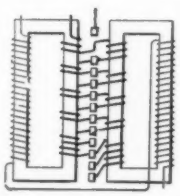
Issued by the United States Patent Office, November 11, 1913.

1,077,972. Relay for Two-Wire Notching Systems. E. R. Carichoff, assignor to General Electric Co. For a remote motor-control system.

1,078,012. Time-Recorder. C. E. Tomlinson, assignor to International Time Recording Co. of New York, Endicott, N. Y. Includes an elapsed-time-computing means with electrically operated members individual to each workman.

1,078,013. Electric Horn. C. F. Townsan, Mitchell, S. D. An electromagnet plunger strikes a ball and thereby vibrates the diaphragm.

1,078,019. Speed-Controlled Brake-Release Device. W. V. Turner, assignor to Westinghouse Air Brake Co., Pittsburgh, Pa. Includes electrically controlled valve mechanism.



1,078,076.—Potential Regulator.

1,078,021. Automatic Brake-Valve Device. W. V. Turner, assignor to Westinghouse Air Brake Co. An electric switch operates upon a reduction in train-pipe pressure to open the circuit supplying the car motors.

1,078,035. Automatic Electric Despatch System. J. Deschamps, Paris, France. Has separate sectionalized trolleys for the armature and field circuits of the car motors.

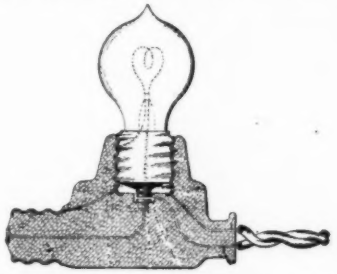
1,078,051. Gliding Switch for Overhead Monorail Tramways. S. H. Libby, assignor to General Electric Co. Has an electric motor for operating the switch.

1,078,058. Timing Device. C. R. Moore, La Fayette, Ind. Includes an electromagnetically actuated pendulum.

1,078,063. Thermostatic Fire-Alarm. J. Rancourt, St. Benoit, Que., Canada. An expanding circuit-closer.

1,078,070. Pontianak Compound and Method of Preparing Same. G. Staunton, assignor to W. S. Potwin, Chicago, Ill. A vulcanizable insulating rubber substitute consists of a plastic compound of coagulated, sulphurized pontianak, oil and lime.

1,078,076. Potential-Regulator. W. Welsch, assignor to General Electric Co. A double-core transformer has a sectionalized secondary with coil groups alternately arranged on adjoining cores and intermediate series-connecting taps. (See cut.)



1,078,172.—Attachment Plug with Pilot Lamp.

1,078,078. Combination Organ Stop-Action. J. T. Austin, assignor to Austin Organ Co., Hartford, Conn. Electromagnets operate the stops.

1,078,106. Harmonic Relay. K. B. Miller, assignor to McMeen & Miller, Chicago, Ill. Has a pair of contacts electrically connected while the reed is vibrating and disconnected when the reed is at rest.

1,078,117. Attachment for Telephone Instruments. W. Wood, San Francisco., Cal. In the base of a desk is a drawer for a pad and pencil.

1,078,127. Railway Signal. J. P. Coleman, assignor to Union Switch & Signal Co., Swissvale, Pa. Electromagnetically controlled semaphore.

1,078,131. Protective Device for Street Cars. E. E. F. Creighton, assignor to General Electric Co. A lightning arrester comprising an electrolytic condenser and a spark gap in series therewith.

1,078,133. Pneumato-Electric Tracker-Bar for Musical Instruments. C. W. Dorricott, assignor to Electrelle Co., Philadelphia, Pa. Has contacts in an air chamber adapted to be actuated by diaphragm pneumatics.

1,078,141. Oil-Cooled Transformer. F. C. Green, assignor to General Electric Co. The oil is circulated from the top of the transformer through a pump and then through a helically coiled pipe in the outer casing.

1,078,181.—Double-Walled Conduit Box.

1,078,156. Switch-Box Lock. F. M. E. Locher, Oakland, Cal. Has a locked closure for the switch-plug opening.

1,078,172. Electric Contact and Indicator. R. T. Smith, Reno, Nev. An attachment plug with pilot lamp at the side arranged so that removal of this lamp breaks both sides of the extension circuit. (See cut.)

1,078,174. Brush-Holder for Dynamos. C. H. Smoot, Chicago, Ill., assignor to Rateau Battu Smoot Co. A light carbon brush has bearing upon it a stiff spring superposed by a heavy mass.

1,079,179. Electric Generating System. H. H. Wait, Chicago, Ill. Two generators operated in parallel have series compensating and compounding windings, the latter being cross-connected.

1,078,181. Box for Electric Conduits. H. J. White, San Francisco, Cal. A double-walled box, the inner wall being perforated and the outer one provided with corresponding knockouts. (See cut on preceding page.)

1,078,194. Brush-Holder for Electric Motors or Generators. E. A. Halbleib, assignor to North East Electric Co., Rochester, N. Y. Has special connections.

1,078,195. Electric Switch. E. A. Halbleib, assignor to North East Electric Co. A triple-contact rotary switch.

1,078,200. Electromagnetic Tachometer. N. M. Hopkins, assignor to Electric-Tachometer Co., Philadelphia, Pa. Includes a generator driven by the shaft which supplies alternating current to several electric indicators with inductances and a thermostatic regulator in series.

1,078,201. Support for Telegraph and Telephone Wires. H. L. Hoybook, Tyler, Tex. A distributing pole carries an annular support for a large number of special peripheral insulators.

1,078,206. Electric Meter. J. Mayer, Seattle, Wash. Has two sets of registering dials, engagement of either with the spindle being governed by clockwork.

1,078,218. Trolley. E. Reddick and J. P. Noel, Hackensack, N. J. On each side of the wheel is a spiral wire-guiding portion.

1,078,225. Electrical Welding of Sheet Metal. E. Thomson, assignor to Thomson Electric Welding Co., Lynn, Mass. A string of contacts for spot welding consists of pieces of sheet metal joined by narrow spacing connections integral therewith.

1,078,226. Method of Welding. R. D. Thomson, assignor to Thomson Electric Welding Co. For electrically welding the end of one piece of stock at an angle to the side of another.

1,078,229. Signaling System. H. G. Webster, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. For telephone circuits.

1,078,233. Interrupter for Ignition Dynamos. H. H. Wixon, assignor to Stromberg Motor Device Co., Chicago, Ill. Has a rotary arm.

1,078,274. Electric Clock. H. Gillette, Chicago, Ill. Secondary clocks are electrically controlled from the seconds wheel of a master clock.

1,078,284. Multiplex-Telegraph System. J. F. D. Hodge, assignor to American District Telegraph Co., New York, N. Y. A combination direct-current and alternating-current system.

1,078,290. Electric Rivet-Furnace. W. S. Johnson and J. W. Sheffer, assignors to American Car & Foundry Co., St. Louis, Mo. Has an electrically heated die closely fitting about the rivet.

1,078,339. Lighting Fixture. M. Egan, New York, N. Y. A semi-indirect fixture with a bell fitting over the lamp socket and carrying arms for the bowl, on top of the arms being a circular glass plate to exclude dust.

1,078,343. Therapeutic Apparatus. A. Fumo, New York, N. Y. Contains a battery and induction coil.

1,078,368. Line Insulator. O. C. Meusenbach, San Antonio, Tex. A metallic inverted channel with insulated pins depending from the web of the channel.

1,078,389. Lamp. H. R. Van Vleck, Montclair, N. J. Combined electric and acetylene headlight.

1,078,404. Electric Switch. C. E. Avery, assignor to Manhattan Electrical Supply Co., New York, N. Y. Special construction for the push-button.

1,078,410. Alarm, Signaling and Controlling Device. E. H. Bock, assignor to Richter, Charlottenburg, Germany. Has a vibratory circuit-closer.

1,078,439. Repulsion Motor Control System. C. B. Hoffmann, Cincinnati, O. Has means to open the short-circuited rotor and to short-circuit a predetermined number of coils of the rotor to hold it in predetermined position.

1,078,445. Portable Electric Reading Lamp. S. J. Levi, T. A. Rose and A. H. Rose, London, England. Includes a lamp bracket and spring clamp.

1,078,458. Fuse Plug. H. T. Paiste, assignor to H. T. Paiste Co., Philadelphia, Pa. A hollow fuse capsule fits into the plug.

1,078,463. Mine Shot-Firing System. G. I. Rawson, St. Louis, Mo. A carriage moves along the series contacts and successively closes the circuits.

1,078,472. Fuse Plug. G. B. Thomas, assignor to Bryant Electric Co., Bridgeport, Conn. Edison plug with cap having a peripheral flange and upwardly extending ribs.

1,078,489. Trolley Guard. P. Dragan, C. D. George and R. J. Palmerio, Philadelphia, Pa. Has a guard plate of and on each side of the wheel.

1,078,494. Bead Chain. W. J. Gagon, assignor to Bryant Electric Co. For pull sockets; consists of hollow balls with connecting dumb-bell links of tubular material.

1,078,523. Knife-Switch Blade. A. K. Sutherland, assignor to Trumbull Electric Mfg. Co., Plainsville, Conn. Is provided near its handle end with recesses and an attaching piece having a longitudinal slot for receiving the blade.

1,078,577. Telephone Bracket. F. Fox, New York, N. Y. For securing to a table or desk.

1,078,586. Socket for Electric Lamps. G. C. Knauff, Chicago, Ill. A double-ended socket for mounting in a wall, one end receiving the lamp and the other end a plug.

1,078,597. Holder for High-Tension Electrodes. A. R. Darling, assignor to Edwards Instrument Co., Indianapolis, Ind. Insulating tube with oil surrounding the central electrode.

Reissue. 13,643. Electrolytic Device for Generating Oxygen and Hydrogen. R. Moritz, assignor to L. Heller & Son, New York. Original No. 981,102, dated Jan. 10, 1911. Extensions on the electrodes are provided with holes to form a continuous duct.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired November 17, 1913.

571,328. Electrically Operated Water-Supply System. J. P. Barrett, Chicago, Ill.

571,351. Electromagnet Signal-Receiving Instrument. S. D. Field, Stockbridge, Mass.

571,362. Magnetic Separator, J. B. Hamilton, Springfield, Mass.

571,363. Electric Governor for Water Wheels. W. W. Handy, Baltimore, Md.

571,372. Process of and Machine for Making Mantles or Hoods for Incandescent Gas Lights. P. Inch, Washington, D. C.

571,399. Telephone Transmitter. D. N. Rowan, Irvington, N. Y.

571,409. Electric Brake. E. A. Sperry, Cleveland, O.

571,410. Electric Controller E. A. Sperry, Cleveland, O.

571,419. Process of Manufacturing Hoods or Mantles for Incandescent Gas-Burners. W. L. Voelker, Elizabeth, N. J.

571,420. Commutator Brush. A. K. Warren, New Brighton, N. Y.

571,426. Electric Thermometer. M. A. Agelasto, Norfolk, Va.

571,435. Electric Railway System. G. J. Forrey, Carlisle, Pa.

571,440. Cable Carrier. E. L. Heidenreich and G. Monrath, Chicago, Ill.

571,441. Electric Signal-Box. W. W. Hibbard, Rochester, N. Y.

571,445. Annunciator. F. A. Jennings, Ithaca, N. Y.

571,454. Rail Support. W. B. Potter, Schenectady, N. Y.

571,460. Primary Battery. S. N. Smith, Minneapolis, Minn.

571,462. Field-Magnet Structure. D. P. Thomson and H. Geisenhoner, Schenectady, N. Y.

571,463. Controlling Electric Arcs. E. Thomson, Swampscott, Mass.

571,467. Regulating Polyphase Circuits. A. H. Armstrong, Schenectady, N. Y.

571,478. Alternating-Current Motor. M. H. Hutin and M. Leblanc, Paris, France.

571,489. Manufacture of Electrical Resistances. A. J. Marquand, Cardiff, and D. Lowdon, Barry Dock, England.

571,502. Electric Elevator. R. Wilson, Louisville, Ky.

571,504. Microphone Transmitter. E. A. Barkalow and N. Crawford, Kokomo, Ind.

571,507. Electric Signaling System. J. P. Buchanan, Boston, Mass.

571,539. Electrical Switch-Conductor. W. H. Sawyer, Providence, R. I.

571,590. Coin-Controlled Mechanism for Telephones. R. D. Gallagher, Jr., Chicago, Ill.

571,594. Cable Terminal-Box. W. H. Johnson, St. Louis, Mo.

571,598. Manufacture of Plates for Electric Accumulators. J. Korner, Mannheim, Germany.

571,600. Controller for Electric Pumps. F. W. Merritt, Duluth, Minn.

571,655. Electric Furnace. A. C. Girard and E. A. G. Street, Paris, France.

571,669. Lightning Arrester. A. De Khotinsky, Boston, Mass.

571,695. Telegraph Switch Mechanism. F. P. Scott, Terre Haute, Ind.

571,706 and 571,707. Electric Cable. S. P. Thompson, London, England.

571,710. Trolley for Electric Cars. S. F. Tufts, Westbrook, Me.

571,723. Electric Gas-Lighting Apparatus. C. W. De Mott, Brooklyn, N. Y.

571,730. Combined Electric-Hydraulic Elevator. J. Parkinson, Los Angeles, Cal.

571,731. Combined Electric-Hydraulic Screw-Controlled Elevator Engine. J. Parkinson.

571,732. Combined Electric-Hydraulic Elevator. J. Parkinson.

571,734. Electric Cutout. B. F. Rout. Stamford, Conn.